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S.I.

PREFACE.

IN this volume an illustration is given of the opportunity for study in animal bionomics. Mr. Richard Elmhirst contributed his own observations on the "yawning" of fishes, a practice little recorded, but one which Mr. Heneage Cocks subsequently showed was long known to himself, though he had looked upon it as a well-known habit common to most, if not all, vertebrates. Other contributors have shown that yawning is not uncommon among Rodents, though Mr. Elmhirst had been unable to find any records of such a custom, proof being thus afforded of the value of recording bionomical observations which may wrongly be considered as either trivial or within general knowledge. The importance of such facts may easily be underestimated at the time they are published, but they provide material for future generalisations, and always receive a hearty welcome in the pages of 'THE ZOOLOGIST.'

In zoological speculation the comparison of animal instinct with reason is a subject which has long exercised philosophers, and is still to be regarded as an open question largely from the imperfect definitions of those two terms. Mr. Dodsworth has again opened the discussion in these pages by his paper on "Mental Powers of Animals," which has in the usual way induced other contributors to record supplementary facts from their own personal observation. This is another field in which many records may appear unimportant, but their value is of a cumulative description, and they supply the material for an

ultimate decision. In every speculation one fact is more than equal to many suggestions.

Ornithology is again to the front in 'THE ZOOLOGIST,' and British Birds still present an inexhaustible subject to field naturalists. A recent paper by Mr. Brock on the "Willow-Wrens of a Lothian Wood" is an example of patient work, and one to be continued in other localities. Mr. Stubbs has found several original topics of the greatest interest, while in "Notes and Queries" alone are published records and observations which cannot escape reference in any future standard work on the birds of these islands.

We again rejoice in the wider field of zoology that this Journal represents. Prof. McIntosh's memoir on the "Red or Precious Coral" is a definite example; Col. Shepherd and Mr. A. H. Patterson have continued to show the interest appertaining to fishes from both the anatomical and observational methods, the latter writer persistently adding to the list of fishes found along our eastern coast.

The present monthly number of 'THE ZOOLOGIST' is *eight hundred and thirty-four*. During all those many months a steady record of zoological observations has been continued. Our Journal has thus had a past; it is for our contributors to give it a future.

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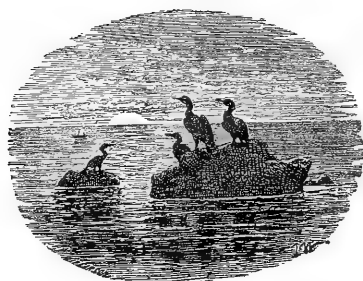
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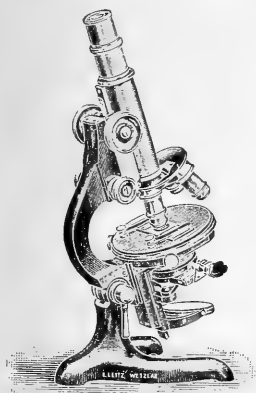
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A BRIEF SKETCH OF THE RED OR PRECIOUS CORAL.

By Prof. McINTOSH, M.D., LL.D., F.R.S.

Gatty Marine Laboratory, St. Andrews.

"THE capture of marine products for food or for commerce has in some cases been carried on for centuries before science stepped in to ascertain their nature, map out their life-histories, and indicate the true course for legislative interference. The fishing for the red coral of commerce in this respect agrees with that for the food-fishes. Both had been carried on for centuries before they attracted the earnest attention of the scientific, and both are examples of the long-continued prevalence of error, and, in the case of the fishes, even culpable lack of knowledge about a food-supply so important. Indeed, the application of science to the problem of the food-fishes is of much more recent date than that of the coral of commerce, just as if personal adornment and not practical utility were of primary importance in the world."*

From one point of view there is, in the scientific history of the two fisheries, certain elements in common which cannot but strike the thoughtful observer, and though in the one case they assume the form of dogged adherence to preconceived and erroneous interpretations, and on the other consist of a choice of crude beliefs often interwoven and warped by political exigencies, yet in both the same obstinate refusal to accept the scientific position is manifest.

* 'Resources of the Sea,' p. 11.

The older writers made no fanciful remark when they stated that, with the exception of pearls and ambergris, no product of the sea was fraught with greater interest than the red or precious coral of commerce. Its early history is obscure, but it is stated* to have been an important article of trade with the Gauls, who decorated their weapons and helmets with it. About the beginning of the Christian era, however, the commerce in coral between the Mediterranean and India seems to have absorbed so much of the attention of the enterprising merchants that, Pliny observes, it was even rare in the regions which produced it. The natives of India considered this coral was endowed with mysterious or sacred properties,† and that its wearer was protected from all evil, and that it was a cure for sterility; nor need we think them specially superstitious when we remember the tiny bags of camphor suspended from our necks in childhood.

The citizens of ancient Rome again hung it round their children's necks as a charm "to preserve and fasten their teeth," and to save them from "falling sickness": and in Italy even now the wearer is protected from the "evil eye," and is cured of certain maladies, while at the same time it prevents the skin of the neck from being chafed.‡ Gansius, further, lauded it as a preservative from the effects of thunder, the shade of Satan, a fertilizer of the field, and, when worn round the neck, a cure for gastric pains and many other ills.§

The economic aspects of coral (*Corallium rubrum*) thus for ages formed the sole attraction to mankind, its very origin being shrouded in mystery. At one time it was considered a petrification, a red plant turned into stone by the touch of the Gorgon's head or hand, and valued by the Persian as a talisman, which, in the hour of triumph, purified the hand which had shed blood. It was, moreover, supposed by such as Ovid, Sextus Empiricus, and Boyle to be soft in the sea, and to be only solidified by contact with the air. Theophrastes, a disciple of Aristotle, Dioscorides, Pliny, Cæsalpinus, Ray, Geoffroy, and Shaw con-

* Encyclop. Brit., article "Red Coral," ninth edition, 1877. See in this connection an interesting Address by Prof. Hickson on "Precious Corals," 1905, Manchester Microsc. Soc.

† *Ibid.*

‡ Simmonds.

§ Other maladies in which red coral was used are given by Prof. Hickson *op. cit.*

sidered it to be a plant, but they knew not its origin or formation. Ferrante Imperato also concluded that its vegetable nature was evident, and Tournefort placed it amongst the stony marine plants. Rumpf, however, from his practical acquaintance with marine organisms, took a different view. This opinion was further strengthened by Boccone's observation of the milky juice in the living structure, and by Marsigli's discovery* of the pale flowers, resembling cloves in shape, which appeared on its surface. Boccone (the Sicilian), however, resiled from his original view, and by-and-by combatted the notion that it was a plant. Guisonæus, a physician of Avignon, in his letter to Boccone, affirms positively that red coral is only a mineral, composed of much salt and a small quantity of earth, while its form is given by precipitation, like that of the *arbor Dianæ* of the chemists. Swammerdam, the celebrated *savant* of Holland, held similar opinions. Dr. Woodward considered red corals were stones, from their exceeding hardness and specific gravity, and especially by observing that when calcined they were converted into lime. The distinguished Réaumur at first thought the independent central hard part was a concretion, whilst the enveloping softer rind was the plant. He declined to believe that the whole was formed by the so-called "insects," but he subsequently, along with Bernard de Jussieu, after an examination of living polyps of various kinds on the shores of France, wholly altered his opinion.

As an example of the views in our own country about the beginning of the eighteenth century (1705), Mr. Anthony van Leeuwenhoek, F.R.S., may be cited.† He held that blood-coral did not grow, but was coagulated on shells. It lost its colour by heat, was not dissolved by either hot or cold water but was so by acid (*aqua fortis*), that its hardness arose from the great number of its fixed salts, and that it was composed of particles which puzzled him greatly. He also assured himself that coral can be of no manner of service—as physic—to the bodies of men, "unless it were to amuse common people with uncommon medicines, and thereby get themselves (that is, certain physicians)

* 1706. 'Histoire Physique de la Mer.'

† Philos. Trans. 1708-1709, pp. 126 *et seq.*

a name, whilst they are in the meantime only cheating the world, of which we have so many examples.”* Leeuwenhoek apparently could not satisfy himself as to whether the coral was an accretion or a plant, being confused by the particles forming the mass of the dried structure.

Thus halting between a petrification and a plant, the position of red coral was uncertain. About the beginning of the eighteenth century, however, a talented young French surgeon, Peyssonnel, who had been initiated into the study of marine organisms by Marsigli, and who was acquainted with the views of the older authors in regard to anemones and other plant-like animals, formed a very different opinion, and by a careful study of the coral in a living and fresh condition, he discovered that it was the formation of polypes. A native of Marseilles, and a student of marine zoology from early days, he qualified in medicine, and subsequently found opportunities to pursue his researches on red coral. His familiarity with sea-life during various voyages to America, St. Domingo, and Egypt enabled him to join the rough coral fishermen in their boats on the Algerian coral-grounds, which had been known to the Pisans in the tenth century.

Fully aware of what his master in zoology, Count Marsigli, had discovered, *viz.* the flowers of the so-called coral-plant, Peyssonnel, as soon as the coral was brought by the fishermen near the surface, plunged a jar into the water and inserted several branches. After some hours he noticed white points over the surface, corresponding to the holes which pierced the outer covering or so-called bark. Gradually expanding, these points assumed a radiate structure, each somewhat resembling the flower of the clove, as described by Marsigli. Continued study of these structures convinced Peyssonnel that they were truly coral “insects,” each of which he termed *urtica*, *purpura*, or polype, and which expands itself in water, and contracts itself in air or when irritated. He thought that each polyp issued from its cavity or cell in the bark, while in the tubes were the organs of the animal, the glandules being the extremities of the feet, and the whole containing the liquor or milk of coral, corresponding to the blood and juices.

* Philos. Trans. 1708-1709, p. 134.

Before Peyssonnel gave full descriptions of the polyp and its physiology he had an opportunity of studying the polyps of a madrepore, which he says are much larger and more easily examined. Each is placed in the centre of a pore, and causes the structure to increase in every direction by lifting itself further and further from the centre of the stone. Each deposits a liquor which runs along the furrow, becomes hard, and causes the coral to increase proportionally in every direction. Corals, therefore, are truly zoophytes, formed by the labour of the animals which inhabit them.

Some of his views, as might be expected, were crude. Thus he supposed that corals produced spawn enveloped in a viscous substance, which fastens to rock, glass, broken earthenware, and stones. The egg is duly hatched, and furnishes the animal which resembles the sea-polyp. It is now known that the egg is developed internally, and that a ciliated larva issues from the mouth of the polyp. He also erroneously imagined that a particular tube (gut), which in the cuttlefish secretes ink, in this case secretes matter which hardens into the dense axis of the coral. Nature, he quaintly says, had furnished these animals with claws (tentacles), which seize their prey as it passes, and thus they are nourished.*

He described two kinds of apparatus used in coral-fishing—one for smooth ground (same as described by Gassendi in his life of Peyreskios), the other, the *salabre*, where the bottom is rocky. Peyssonnel found that coral grew amongst the rocks and in the caverns plentifully in ten to twelve fathoms of water, but also as deep as one hundred and twenty fathoms. He cites the coast of Barbary, which lies open to the north, as a proof that coral flourishes there as well as in southern exposures.

When Peyssonnel's observations were first communicated to the French Academy, they were received for the most part with incredulity and opposition. There was little sympathy, indeed, with the young surgeon who had so loyally stood by his

* Justice is done to Peyssonnel both by Milne-Edwards in his *Hist. Nat. des Coralliaires*, Suites a Buffon, 1857, and by Lecaze Duthiers in his *Hist. Nat. du Corail*, 1864. The former gives interesting quotations from the manuscript of Peyssonnel preserved in the Library of the Museum of Natural History, Paris.

father, whose devotion to his fellow-citizens during the plague cost him his life, and whose own discoveries were an honour to his country. He received from the King, however, a mission to explore the shores of Barbary, and was thus enabled to forward additional observations to Paris. These, while giving rise to fresh discussions and renewed combats in the Academy, caused some, such as Flourens, to perceive the importance of Peyssonnel's discovery. Three members of the Academy, moreover, after personally investigating the subject, ranged themselves on the side of Peyssonnel, *viz.* Bernard de Jussieu, Réaumur, and Guettard. Their notions, however, of the relation of the polyps to the solid axis of the coral were inexact, especially those of Réaumur, who compared the coral to the bee and its cells. Fresh opposition was thus engendered to Peyssonnel's views, for which he was not responsible. These memorable discussions, however, decided by-and-by the position of the red coral. Henceforth it was admitted to be a product of animals. Yet here and there doubts subsequently appeared. Thus Donati,* an Italian naturalist, attempted to unite the diverse views of Marsigli and Peyssonnel by asserting that red coral showed the vegetation of a plant and the propagation of an animal, therefore it should be placed in an intermediate position. This author gives a fair account, with figures, of the polyps with their pinnate tentacles, and of a section of the axis and cænosarc of the corallium. He appears, however, to have been unable to shake off preconceived notions.

Such views, however, and those of Dr. Parsons in the 'Philosophical Transactions'† to the effect that, though Peyssonnel did find animals on the coral, it need not be concluded that they constructed it, gradually died away, and the investigations of Cavolini (1785) and Milne-Edwards on the one hand, and the more recent work of Lacaze Duthiers on the other, did justice to the researches of the young French surgeon and naturalist.

Peyssonnel was thus the discoverer of the true nature of coral, and he resolutely defended his views against the French *savants*. Disgusted, however, at the reception his labours met with, and the absence of all encouragement in his zoological

* 'Della Storia Naturale Marina dell' Adriatico, Venezia, 1750,' p. xliii, tav. v.
 † 1751-1752, p. 505.

studies, he accepted the post of physician-botanist to the Island of Guadaloupe, and never again entered France or sent a paper to the Academy. His completed researches, indeed, were communicated to the Royal Society of London, and did not appear in French. As Lacaze Duthiers truly says, he merited other treatment from his countrymen. His devotion during the plague at Marseilles,* his enthusiasm and courage in encountering danger and fatigue during his explorations of the African coast, and his discovery of the nature of coral ought to have assured him a distinguished name. He was one of the band of surgeon-naturalists (to whom allusion has more than once been made) who have done so much both at home and abroad for the progress of zoological science, yet whose labours and whose influence have escaped the just consideration of the late University Commissioners for Scotland. Though by statutory injunction the future medical graduate must write a thesis on a purely medical subject, and not on a zoological or a botanical one—a freedom which his predecessors enjoyed—it is unlikely that the indissoluble brotherhood between these two subjects and medicine will heed either appreciation or sympathy. In the future as in the past the ranks of medicine surely will produce men like Peyssonnel and Rigaut, Rondelet, Kölliker, Ehlers, William Harvey, Alex. Monro, Erasmus Darwin, Sir Hans Sloane, John and William Hunter, John Goodsir, John Reid, George Busk, W. B. Carpenter, John Hutton Balfour, G. J. Allman, James Syme, Joseph Hooker, Richard Owen, Thomas Huxley, William Flower, William Turner, George Johnston, Albany Hancock, Robert Grant, Alex. Dickson, G. S. Brady, J. B. Pettigrew, Alleyne Nicholson, Robert Edmonstone, and many others, whose services to medicine and to zoology and botany have been and are an honour to their respective countries.

The red or precious coral, then, frequents a rocky bottom on the borders of the Mediterranean and its islands, and is most abundant at depths from twenty-five to fifty fathoms, but may extend to about one thousand fathoms. Its distribution in quantity is indicated by the titles of the various fisheries. Thus it occurs on the shores of Southern Italy, off the Island of Ponza,

* He wrote a youthful memoir on the contagion of the plague, for which the Academy made him a Correspondent.

in the Gulf of Gaeta, off Sicily, especially at Trapani at its western extremity, off Corsica and Sardinia, in the Straits of Bonifacio, off the Mediterranean shores of France, at Marseilles and Provence, off Catalonia, off Tunis, Algiers, and the shores of Morocco, as well as the Ionian Sea, and Cape Verde Islands in the Atlantic. Other species of corals come from the Mauritius and Djilolo.* “The valuable pink coral is found chiefly off the coast of Sicily. In the year 1875 a bed was discovered in the Straits of Messina, in which the coral, though found only in small quantities and of small size, was of immense value, owing to its beautiful uniform pink colour, and without any of those stains which detract so much from its worth. The coral found in this place was sent chiefly to London and Birmingham. Its value is from £80 to upwards of £200 per ounce.”† The supply of this coral, however, was of short duration. It is usually attached to the under surface of stones and rocks on the so-called banks, which the coral fishermen (corallini) find with remarkable skill; indeed, Lacaze Duthiers says they are as well acquainted with these as with the islands which rise above the sea. Moreover, it would appear to flourish better where the bottom is muddy than where it is clear or sandy. By its base it clings firmly to stones, rocks, and other surfaces, penetrating the small crevices, and often having various growths such as Polyzoa and Melobesia externally, while occasionally it envelops a shell (*Thecidium*), a sea-acorn (coral-tulip), or a piece of wood.

Coral varies in appearance, some specimens being larger and more branched, others shorter and less branched, age having a considerable effect in modifying its aspect. Rarely are the branches regular, since accidents of various kinds and the death of parts occur. Its hard axis is capable of taking a fine polish, as also is that of certain allied forms such as *Pleurocorallium*.‡

Most authors who have examined it in life have had considerable difficulty in carrying out their wishes—from the days of Peyssonnel till now—for the boats are often a long time at sea. Their owners are somewhat suspicious of strangers on board, both in connection with the coral itself and the distraction of the

* See Hickson, Camb. Nat. Hist. vol. 1906, “Cœlenterata,” &c., p. 352.

† Greck & Co., *in litt.* to Prof. Moseley, ‘Nature,’ March, 1882.

‡ J. Yate Johnson, Proc. Zool. Soc. 1899, p. 57.

workers, while a certain amount of secrecy still haunts the pursuit. Moreover, the trials of such a life are not few. Even with every advantage it is by no means easy to secure specimens that will live, for the tangles and other instruments of capture inflict injuries which in warm weather prove fatal. Lacaze Duthiers was most successful by selecting uninjured specimens on stones, and suspending them in vessels of sea-water.

Like all the members of the group *Alcyonaria*, to which red coral belongs, the polyps on its surface have eight pinnate arms, but instead of being red, or, as some of the older authors called them, "flowers of blood," they are pale and transparent. When contracted the surface of the coral is dotted with little elevations marked by deep radiate grooves, and from each of these, in sea-water, a polyp by-and-by expands. These polyps of the red coral were the flowers of Marsigli,* and about which, in the earlier days of Peyssonnel's discovery, so many opposing views were broached. The hollow, pinnate tentacles (with thread-cells) surround the mouth, which is in the centre, being ciliated, and send currents of water (bearing food) into the digestive system. Around the latter are eight radiating lamellæ (mesenteries) and other organs. The polyps, moreover, are dimorphic (autozooids and siphonozooids, the latter without ova or generative organs). These polyps thus resemble those of the common *Alcyonium digitatum*, the "dead men's fingers and toes" of the fishermen, yet it is remarkable that in a country of marine zoologists like Britain scarcely a single figure representing these beautiful polyps in their natural condition exists, for Prof. Hickson does not figure a fully expanded polyp in his excellent brochure on *Alcyonium*,† whilst the figures of the expanded polyp in his finely illustrated Memoir‡ also lack the beauty of the perfectly healthy example. Prof. Hickson, indeed, explains that when at Plymouth he never succeeded in getting *Alcyonium* to expand to his satisfaction, even the figure in the recent Cambridge Natural History (1906) being indifferent, for it apparently has been taken from a specimen by no means vigorous, and the striking diffe-

* They essentially differed, however, as Lacaze Duthiers pointed out, for when touched they contract.

† L. M. B. C. Memoirs, v. 1901.

‡ Quart. Journ. Micros. Sc. vol. xxxvii. pls. 36 and 37.

rences between the fully expanded polyps and the shrunken apertures into which they have disappeared lack tone. It is rare to find one collected by hook, dredge, or trawl in a satisfactory condition—indeed, such has never been seen. The only method of securing a perfect example is, as stated in 1864,* by searching for small specimens near low-water mark under stones, chipping them carefully with a basis of stone, and at once placing them in sea-water. Thus a patch three-quarters of an inch in diameter contracted to one-tenth of an inch in thickness. “As the polyp contracts into its stellate aperture its mouth gapes, apparently the more readily to give exit to the water in its interior. It presents the aspect of an octagon with hollow sides when about the level of its cell. Rows of spicula project from the corners towards the centre. If further extended the tentacula, their pinnæ, and the rows of spicula become more apparent; oral aperture dilated; outline of oral disc similarly octagonal, though much larger. When still further extended, coiling of the arms is frequently seen, like the circinate veneration of the ferns. In a state of full expansion the polyp is elongated and narrowed toward the head, measuring more than half an inch from the tips of the tentacula to the base. The tentacles can be stretched to more than twice the diameter of the oral disc, are narrow and tapering, and have the elongated pinnæ at each side; the tips are slightly opaque, probably from minute suckers. The tentacles are also rendered rough by minute spicula, which do not, however, go further than the base, where a pale non-spicular portion occurs; below this the neck of the polyp is supplied with long tuberculated spicules, arranged in an arrow-like manner. In those polyps which are best expanded the diameter of the oral disc is smallest. Sometimes, from the position of the parts, the tentacle with its pinnæ presents a spindle-shaped appearance.”† The spicules of the tentacles appear to have had but little attention paid to them, though they are figured by Prof. Hickson in his Memoir (vol. 37, fig. 10), and alluded to on p. 370.‡

* Proc. Roy. Soc. Edin. vol. v. p. 393, 1862–66.

† An accurate drawing of this example by the late Mrs. Günther is given in ‘The Marine Invertebrates and Fishes of St. Andrews,’ pl. vii. fig. 8, 1875.

‡ *Op. cit.*

The fleshy external part (cœnenchyma), in which the polyps are placed, is canaliferous, has spicules, which are, according to Ridley, of one type, "*viz.* a hexahedral oblong form, the angles being formed by broad truncate but microtuberculate tubercles which preserve the chief features of their characteristic form throughout all varieties of the external form of the coral."* It surrounds the dense, inflexible, calcareous axial part (the coral of commerce), which consists of fused spicules formed by the fleshy part, and it is stated to be devoid of an investing cellular (epithelial) layer, whereas *Gorgonia* and its immediate allies have the latter, the central rod in these being ectodermal. Cavolini compared the fleshy and the hard parts to periosteum and bone—a somewhat crude simile—while Boccone thought the hard axis was only formed by juxtaposition.

The vessels ramify through the whole of the fleshy part, the larger parallel ones next the hard axis, the smaller forming a reticulation throughout the entire layer. They carry a nutritive fluid originating in the chyme in the interior of the polyps, as clearly described by Peyssonnel. It is the so-called "milk" of coral. The fleshy part is translucent when distended by water, is cellular, and has the calcareous spicules already mentioned. Externally is the cellular ectoderm, which by fusion of its cells appears as a structureless layer. The fleshy part has a tendency to produce buds everywhere, even injuries being followed not only by repair but by branching.

The sexes of the red coral are generally borne on separate colonies; rarely both occur on the same branch. No external distinction exists between them, except that in dead branches the eggs become yellow, whereas the products of the males remain milky. Both elements are produced in the sarcosome in the deeper parts of the polyps, as in *Alcyonium*. The eggs are developed internally, and the larva escapes by the mouth (as a planula) from May to September, and occasionally as late as December. A close-time, therefore, could only be carried out by the division of the entire coral-bearing area into sections. The larva swims freely in the water, and becomes pear-shaped before fixation, sinks to the bottom, fixes itself to stone or rock, and becomes flattened.

* Proc. Zool. Soc. 1882, p. 223.

The rate of growth is still uncertain. Some assert that coral grows with tolerable rapidity, and that articles thrown into the sea will in a few months be studded with small specimens. Others, again, hold that it takes twenty years to produce an axis as thick as the forefinger.

Previous to the sixteenth century the coral fishery was controlled by the Italians; thereafter for a short time it was in the hands of the Spaniards; then the French held it till 1793, the centre of the trade being Marseilles, when the Revolution threw it open. Though the British Government took charge of the fisheries for a short time (1806), the industry since that period has been mainly Italian.

The coral fishery is carried out in decked boats of two sizes, *viz.* six and fourteen to sixteen tons. The former are chiefly French, though manned by Italians; the latter Italian, mostly from Torre del Greco, where the inhabitants are nearly all engaged in this fishery, either as fishermen or manufacturers of coral brought on shore. Smaller boats without a capstan are also used by the Spaniards, and with only three or four men on board, whereas the former have respectively six and ten or twelve men. Many of the men come from the coast of Tuscany, a few are Genoese, most are Neapolitan, and more especially from Torre del Greco (near the foot of Vesuvius). No French crews will undertake the work. In the large boats is a captain, a second in command, and eight or ten fishermen. The best fishermen get from four hundred to five hundred francs for the six summer months. The greater number get from two hundred to three hundred francs.* The fishing season is from March till October, but weather permitting it may be prosecuted at all times. Whilst the food of the men consists chiefly of biscuits and water, Italian pie, and a few vegetables, their muscular exertions are very great as well as long-continued, since they work night and day—often in the broiling sun of the African shores—relieving each other in shifts of six hours. The hardships of the life are, indeed, a byword.

* Simmonds ('Commercial Produce of Sea') says from £20 to £24, and the masters twice as much. See also 'Nature,' vol. 25, p. 511 (March 30th, 1882), for a letter from Messrs. Greek & Co., describing the Italian coral fishery.

Each boat is provided with an apparatus or engine formed of a cross of wood, a metre long in the smaller, and two metres in the larger. Sometimes an iron centre is used with sockets for the arms. The latter are made of stout wood, and in the centre (when no iron is present) is a large stone, while a series of tangles made of hempen ropes and pieces of net are attached to the cross. The tangles are about a yard or more in length, and, in the larger boats, from twenty-eight to thirty in number. Under the central stone is often a circlet of six or eight tangles, which the fishermen call "the tail of Purgatory." The main rope passes from the centre of the cross, and is protected from friction by a sheath of lashing, and shorter ropes connect the beams to the central one so as to increase the strength of the apparatus.* The Spaniards use a perforated iron instrument with teeth, and a bag of net to entangle the coral, but no special advantage is gained.

When the captain thinks the ground is suitable he launches the engine, the sails (lateen and jib) are trimmed, and the capstan put in action. The cross of wood fixes on rocks and stones, breaking off the coral and overturning the latter. Pulled on by the rope it advances by jerks, the horizontal action of the sails being combined with the vertical action of the capstan. Now it may be necessary to give more rope or reverse the action of the boat and capstan, and again proceed, all being done under the orders of the captain, who is the stern and inflexible master of the toilsome pursuit. As the huge stones are overturned and the corals broken off, the tangles pick up the loose pieces, besides starfishes, fin-shells or sea-wings (*Pinna*), lamp-shells, and other invertebrates.

The fishermen engaged in this arduous work are naked, with the exception of drawers. When busy they chant various songs, often including the names of their favourite saints, swaying their heads and bodies to the song, and straining every muscle at their exhausting work. The work of these men thus resembles in some respects that of the eager trawlers in our waters.

Should the engine become fixed and resist all efforts to disengage it, an iron ring is sent down on the main rope to free

* *Vide* a figure on the covers of the 'Resources of the Sea,' 1899. This was sketched from the apparatus exhibited in the London 'Fisheries' Exhibition of 1883.

the wooden cross, and a kind of grappling-iron (harrow) to disentangle the hemp which may have become twisted round rocks. Thus continuing their weary labours, the apparatus is hauled on deck, and an eager search is made for coral amongst the tangles. Every fragment is carefully picked out, and stored for the owner of the boat, for no one employed in the fishery is permitted to sell coral.

Coral is separated into *Dead Coral* (or *pourris*), which is sold at a price varying from 5–20 francs a kilogramme (2 lb. 8 oz.). *Black Coral*, 12–15 francs per kilogramme. *Coral in case* (*caisse*), 45–70 francs a kilogramme (ordinary commercial coral). *Choice Coral*, 400–500 francs per kilogramme,* including rose coral and *peau d'ange* (angel's skin), off Sicily and Straits of Messina. The finest rose tint is worth £120 per oz. Rare kinds of pale tints are worth twenty times their weight in gold (Simmonds). It is occasionally milk-white.

The large boats are valued at £550, and their outlay averages about 11,000 francs per season. From 400 to 600 boats were engaged in 1880; in 1871 there were 460 Italian boats, valued at £80 and £160 each (Simmonds). About 6000 Italians and Spaniards were occupied on the Algerian banks in 1864. In 1873 the Algerian fishery employed 311 vessels, manned by 3150 men, and yielded coral valued at £13,000. The Spanish fishermen collect off the Cape Verde Islands about 24,760 lb. of coral = £20,000. Large boats may collect from 650 to 850 lb. of coral in the season, value from 13,000 francs to 24,000 francs. If 250 kilogrammes are procured at 50 francs it covers expenses. Foreign boats pay heavy dues for right to fish on the Algerian coast.

A diver's dress (*Scaphandre*) for the coral fishery in shallow water has been suggested, but it appears to be unsuitable. The same applies to a submarine boat. A steam capstan is a more reasonable proposal.

Coral is often perforated by sponges and annelids, besides having externally various tubes of *Sepula* (*Spirorbis*), and other encrusting forms. On the Spanish coast fine blood-red coral is

* Some of the finest from Sicilian grounds and Straits of Messina is sent to London and Birmingham, to be cut into lentils, and, as stated, is valued at £80 to £200 per oz.

found affected by filaments of a parasitic alga, which causes a change in the tissue. The same parasite is found on *Astroïdes* and molluscan shells.

The produce of the coral fishery is sold in Messina, Naples, Genoa, Leghorn, Marseilles, and the Algerian coral goes in addition to Pisa, in Sicily, and Trapani. About 160 tons are annually brought into Italy, and the articles made of it are valued at nearly £500,000. The total annual value of rough coral has been estimated at £2,000,000, while, when manufactured, it reaches £10,000,000. Great skill is shown by the Italians in sculpturing and polishing coral. The finest must be of a delicate pinkish or flesh-like hue, uniform in tint throughout, and in large pieces. "It has the hardness and brilliancy of agate, and shines like garnet with the tints of the ruby."* Inferior kinds are sold at £2 per oz., and small fragments, "collete," used for children's necklaces, at 5s. per oz. Even worm-eaten coral, of little value in Europe, goes to the East, for the natives believe that gods dwell in the little holes. Arabic coral of inferior quality is also made into simple cylinders pierced lengthwise, and sold for servants' use.

The finest workmanship perhaps is seen at Naples and Leghorn, and in the form of pearls, large and small, smooth and faceted, olives, sculptured men, animals, flowers, fruits, or rounded buttons, the largest and finest of which go to China for the Mandarins' caps. "In Leghorn about 1000 women are employed preparing 50,000 lb. of coral into little beads—round, egg-shaped, smooth, and cut into facets. The greater part is sent to India, but also to Germany and Russia."† The same author states that in 1879 Genoa had thirty engravers of cameos and coral. In all from 5000 to 6000 persons gained a livelihood in the province in connection with coral, the craft producing a revenue of £80,000. Marseilles, again, manufactures 2,000,000 francs of coral. Manufactured coral is exported to Egypt, India, Thibet, China, Britain, the European States, and America. In the latter and the West Indies the blacks have a great fancy for coral, and so in Morocco, India and Central Asia, Central Africa and America, and as in these countries and in some European States the dead carry the coral ornaments with them

* Simmonds, 'Commercial Produce of Sea,' 1879, p. 441. † *Ibid.*

to the tomb, the demand is constant. In our own country coral beads and other personal ornaments are common. Between 1860 and 1870 Simmonds mentions that £300,000 worth of coral was received in Britain. Very costly articles of jewellery, indeed, may be formed from it, a single set occasionally reaching £1000. A fine piece (8 in. long), exquisitely carved and forming the handle of a parasol, was valued at £70 (Simmonds).

The antiquity of the coral fishery, the comparative freedom in regard to working, and the exhaustion of certain banks, have led to suggestions for restriction—for instance, to make a close season during the development of the eggs—but as this period stretches from April to September, and even later, the very season when the fishery can best be carried on, the suggestion, as already indicated, is impracticable.

The fact that small quantities are procured from a bank that has been persistently fished for some time, whereas numerous and fine specimens occur on a new bank, or one that has had a long rest, point to the propriety of intermitting the work. This was further exemplified after the four years' rest of the Egyptian campaign. Lacaze Duthiers thus advised that the Algerian region should be divided into five areas, each of which should be fished in succession, after a four years' rest, so that this suggestion as applied to the food-fishes of the North Sea is not new. The conditions, however, of the two groups, *viz.* coral and food-fishes, widely diverge. The Algerian reefs, indeed, were divided into ten portions, only one of which was fished annually, ten years being considered sufficient for the growth of large pieces of coral.

Of important banks in recent times, that of Sciacca (near Sicily) may be mentioned. This was discovered in the middle of May, 1875, and large supplies attached to groups of bivalve shells or pieces of dead coral, chiefly of red or black coral, were obtained. Thus a boat with eight men collected from thirty to forty pounds a day, and it sold at eleven shillings per pound less five per cent. tare, so that each boat had a daily gain of about £20. By the middle of July the coral sold at only seven shillings per pound and eight per cent. tare, and towards the end of the month considerably less. It was estimated by Simmonds that from June 1st to August 31st, 1875, the quantity of coral sold

at an average price of seven shillings per pound was 264,000 lb., or = £92,000. In the case of Sciacca about seven hundred boats crowded the beds, so that a Government ship had to be sent to keep order. Another bed was found ten miles off, and still another further removed (1880). About eight thousand tons of coral were fished on these banks, reddish and black (which Moseley supposed to be due to manganese, since he found shells elsewhere with blackish deposit of manganese). The Sciacca coral was chiefly attached to shells and fragments of corals, not to rocks and stones; depth, one hundred to one hundred and seventy fathoms. Greck & Co. say that the dark colour appeared to be due to the muddiness of the water. This coral found ready sale in English markets, being prepared for Calcutta. It was exposed for months to the heat of the sun and kept moist, when the black colour disappeared.*

Prof. Giglioli (to whom I am indebted for interesting information on the subject), however, mentions that, although this bank was worked till it by-and-by was exhausted, others were found in the same region. Thus on the banks worked from March to October, 1882, coral was procured to the amount of £179,724. There were, indeed, 582 boats and 5766 men on the area. Moreover, it was chiefly dead coral, and sold at a low price.

Between the years 1880 and 1883 much coral was got on the extreme edge of "Adventure Bank," not far from Graham's Island (Ferdinandea), and principally in three patches. It was, however, dead and blackened, probably from the volcanic eruption which caused the island to appear and disappear in 1831.

The fact that no minute survey of the Mediterranean has been made, so as to map out the rich coral-banks with their fauna and environment, and that no very accurate statistics have been kept of the captures from year to year, show that great caution is needed in drawing deductions.

Recently a species of coral (*C. johnsoni*), which is known off Madeira, was dredged in 388 fathoms about sixty miles off Eagle Island, on the west coast of Ireland, where so many

* *In litt.* Messrs. Greck & Co. to Prof. Moseley. The most recent account is that of Canestrini, 'Il Corallo, Monografia,' 1883.

rare forms have been procured under the skilled auspices of Mr. Holt, Scientific Adviser to the Fisheries Department."*

An artificial substitute—coraline—is used for cheap jewellery, but the beads are too regular, smooth, and uniform in tint to pass for the genuine article.

A story is told by Simmonds of certain distinguished foreigners who admired a string of large coral beads in a shop in London, but expressed astonishment at the high price. Some time after they visited the same shop and expressed indignation at the imposition attempted to be practised on them, since they had purchased a similar article for one-tenth of the price. They were asked to put the two articles to test with a knife. The true coral was uninjured, but the artificial composition splintered. An appeal to a law court for redress of the fraud was the result.

Ivory beads are also sometimes dyed to imitate coral (Simmonds).

On the Pacific coast of Japan rocky coral banks of great richness were known in the seas of Tosa long ago, and coral was occasionally taken off the coast of Tsukinada in early times. In the time of the Daimyos, however, the fishery or sale of coral was prohibited lest the Daimyo of Tosa might be compelled to hand it over to the Shogun. The grounds off Tosa are the oldest in Japan, and include the Muroto, Tsukinada, and Kashiwajima grounds, and they range from 90–180 metres in depth, and are often very rough. The second or Hizen ground is both the most extensive and the most profitable, and it lies about 65 km. S.S.W. of the Goto Islands, and is from 55–180 metres in depth, both rough and smooth ground being found. The third area is the Satsuma ground, including the small banks to the south of the Koshiki Islands, and was recently discovered. Prof. Kishinouye describes seven species of *Corallium* from Japanese waters: viz. *C. japonicum*, the most abundant, is known by the name of "Aka-sango."† It comprises two-thirds of the annual proceeds of the commercial fisheries in weight, or from 4000 to 10,000 kilos. The axis (skeleton) is dark red in

* *Vide* Prof. Hickson, 'Nature,' vol. lxxiii. p. 5, 1905.

† An allied species has been recently described by Prof. Hickson from the coast of Timor (K. Akad. Wet. Amsterdam, 1905). In this form the sexual organs are carried by the siphonozoids.

colour with a white centre. A small pit marks each autozoid. A polychæt worm (Eunicid ?) is a commensal in a burrow on the front of the branches, the large examples of which are about 300 mm. in height and 30 mm. in diameter. Light-coloured varieties are rare and valuable. Two other species—*C. boshuensis*, Kish., and *C. sulcatum*, Kish.—seem to be rare. *C. elatius*, Ridley, on the other hand, is more abundant, and grows to a comparatively enormous size, viz. 100 cm. in height, and about 6 cm. in diameter at the base. It is generally red in colour, rarely colourless, and forms one-fifth in weight of the total annual product of Japanese corals. The other forms are *C. konjoi*, Kish., known by the name of “shiro-sango,” and of considerable size (30 mm. in diameter), and it has a milk-white skeleton with a small reddish centre; *C. inutile*, Kish., a rare species; and *C. pusillum*, Kish., with a white striated skeleton, and only one example of which has been procured.* The common Japanese coral is readily distinguished from the Mediterranean species by the white centre of the main stem and branches. This was unknown to Prof. Moseley, who refers to what he considers a remarkable carved jewel of Japanese coral, which is marbled white and red, and is characterized by its greater hardness when compared with ordinary precious coral.

The history of the coral fishery in Japan is full of interest, since after the interdict of the Daimyo a coral fisher about seventy years ago secretly carried on his occupation on the Moroto ground with profit, and others followed. After the Meiji Reform in 1868, when the prohibition was removed, about one hundred boats worked on the Moroto ground, and soon exhausted it, so that only a few boats were observed in 1886. But by-and-by coral was discovered on the Tsukinada ground, and in such quantity that nearly all the coral fishers flocked to it. While the centre of the fishery was thus at Tsukinada some fishermen again explored the Moroto ground, formerly so rich, and it was found that the corals had again re-established themselves in such force that no fewer than one thousand boats soon were busy on it, a sight never since seen in the coral fishery of Japan. If

* The foregoing abstract of the Japanese corals is from an interesting paper by Prof. Kishinouye in the ‘Journ. of the Imperial Fisheries Bureau,’ vol. xiv. 1, Tokyo, 1904.

any object-lesson could open the eyes of the authorities in our country to the permanence of the food-fishes in the sea, notwithstanding temporary alterations which may or may not be due to man's agency, surely this of the stationary coral of the Japanese seas should.*

Besides the foregoing grounds, a new area, the Hizen ground, near the Danjo Islands, was discovered in 1886; the next year eighty boats were at work, and since then the average has been one hundred boats, and this notwithstanding the sudden storms and the calamities characteristic of the region. The newest or Satsuma ground was opened in 1898, near the islands of Taka and Tsukura, and others have been discovered every year near these islands and those further south, so that one hundred boats work on them. It is probable that all the coral banks have not yet been explored, and that the accidental capture of fragments in line-fishing over this great area may lead to further developments.

The Japanese boats used in the coral fishery are, as a rule, ordinary fishing-boats, and they are manned by six to eight men, though this varies in the different villages. The captain is owner, while all share in the captures. Prof. Kishinouye, to whom I am indebted for much of the information on the subject before the publication of Mr. Kitahara's paper, thinks it is a kind of gambling. At first the men used a rectangular net hanging from a piece of bamboo, but lately tufts of old netting are dragged at the lower edge of the net as well as at both ends of the stick. The rectangular net of strong cord breaks off the coral, and the tufts entangle it. The principle is much the same as in the Mediterranean, and as the Japanese ground is rocky it might be an improvement to supplement by heavier bars of wood, though this would undoubtedly add to the labours of the crew. They work with the current, and find it most profitable to sweep the ground with the net from deeper to shallower water; the best months are May, June, and July. Only the Moroto and Kashiwajima banks are within easy reach of shelter, so, as a rule, when signs of rough weather appear, they return to the harbour.†

* *Vide* 'Resources of the Sea,' pp. 25, 239, &c.

† I am further indebted for information to a paper "On the Coral Fishery of Japan" (Journ. Imperial Fisheries Bureau), by T. Kitahara, 1904.

The coral trade in Japan seems to have been a comparatively recent development, for nearly all the coral ornaments were formerly imported from Italy. Mr. Kitahara shows that the export of coral began to increase about 1896, and culminated in 1900, while the imports suddenly decreased from 1899. The greater part of the Japanese coral goes to Italy, and the minor part to China. The amount for home use is small. The coral exported to Italy is chiefly the "Aka-sango" (*C. japonicum*) and "Momoiro-sango" (*C. elatius*), whilst the latter almost exclusively is sent to China. The "Shiro-sango" (*C. konojoi*) is rarely exported. When first introduced into Naples it sold, notwithstanding its bad colour and somewhat cloudy aspect, for £150 a kilogramme, a price which was due to its large size and hardness. Now it is much cheaper.

In Japan it has been used for two or three centuries chiefly as beads for ladies' hair, cords for tobacco-pouches, "inro" rosaries, and inlaid work. The "Momoiro-sango" is highly appreciated, whilst the others are less valued. Mr. Kitahara concludes with the remark equally applicable to the capture of food-fishes as of coral, *viz.*: "It is generally believed that the coral fishery is quite different from other fisheries from an economical standpoint, for the catch can never be known beforehand, as one boat may get nothing for a whole day's work, while another may get several hundred yen worth in one haul on the same bank! This is true to a certain extent, but I believe it is too much to say so decidedly, because the clever, experienced fishermen who can exactly detect the position of the banks, and clearly understand their contour, and can take advantage of the current in using the net, have always a fair catch."

In conclusion, it may be mentioned that the persistence of the red coral of commerce was alluded to in the 'Resources of the Sea' (p. 12), and this notwithstanding man's efforts to destroy it. It has been eagerly sought for many centuries, and has been captured generally without restriction wherever and whenever the *corallini*, or coral-fishermen, listed. Its growth is comparatively slow, and its powers of increase limited. Moreover, fixed to rocks, stones, shells, and dead pieces of coral at the bottom of the sea, it could neither escape the engines of capture nor, by an adult pelagic habit, aid in the spread of its larvæ

over a wide area. Its resources for continuing the species under disadvantageous circumstances, caused by the constant efforts of man, are : (1) the facility for branching, and the fact that broken branches retain their vitality and grow on a fresh site, while the fixed portion, if not too much reduced, can send up a new stem ; (2) the pelagic nature of the larvæ (true planulæ), which carry to new and suitable sites swarms of the species. Finally, the remarks applied in connection with the sea-fishes are appropriate here, *viz.* : “ Nature has been able by her unaided resources to ward off extinction in a species so eagerly desired by man for one of the greatest incentives, *viz.* pecuniary gain, and yet so circumscribed in distribution, and so slenderly supplied with means of dispersion in comparison with many marine animals. Moreover, all this has occurred in a sea specially excluded, from its limited boundaries, from the consideration of the question in the ‘ Resources of the Sea,’ which has been swept by hundreds of boats’ crews annually by day and by night. If the continuance of the red coral, therefore, has been assured (for authorities deem the diminished price rather than scarcity of coral at the root of the present depression), what difficulty is there in regard to the permanent abundance of the chief food-fishes of the open seaboard of our country—set as it is in the midst of an almost boundless ocean—with all the marvellous powers of increase (a thousand-fold greater than the coral), so characteristic of them on the one hand, and all the varied and gigantic resources of nature in the sea at command on the other ? Science as well as experience answers that there is none.”*

* ‘ Resources of the Sea,’ p. 241.

AN OBSERVATIONAL DIARY ON THE NUPTIAL HABITS
OF THE BLACKCOCK (*TETRAO TETRIX*) IN
SCANDINAVIA AND ENGLAND.

BY EDMUND SELOUS.

(Part I. SCANDINAVIA.)

(Continued from vol. xiii., p. 413.)

April 20th.—Starting at 3 a.m., I must have reached the place about 3.30 a.m. There are the usual early cries, and as light begins slowly to struggle through the mists and shadows of the arena I make out four birds through the glasses—"darkly." A little later, one flies off, if indeed it is only that, for he seems to rise straight up into the air, and I see the white tail, as if it were spread.

Now, just as daylight breaks clearly, there is the pause—no bird on the arena—all, I think, must have flown off when that one did; only a rookle, here and there, round about, and that not near. This pause, or rather interval in the birds' activities, after daybreak, seems an actual thing; but perhaps they are then feeding. Then, as the sun begins to top the rocky ridge of the low hill behind me, come rookles and "tchu-whais," so suddenly, one would think there was really a connection. Nothing more happens, however, no bird, since the semi-darkness, has been down on the "moss," nor is now likely to, it being past the time of gathering. It seems strange that there should be this set-back, since yesterday, but, though a splendid fine morning, passing into a cloudless day, it is still colder than yesterday, so that this may account for it. The shooting, too, which goes on all about in the early morning, in defiance of the unenforced game laws, may have something to do with it. No doubt I have come too early, and may have to leave before I shall have seen much. Yet even the little I saw yesterday goes far to show that the general principles governing the courtship

of the Blackcock are much the same as those which obtain in the case of the Ruff—that is to say, that the female is won by assiduity, or superior attractions, and not by fighting, or force applied to herself. This hen, for instance, rejected both the birds that courted her, not, in all probability because she was indifferent to such courtship in itself, but simply because she required to be better pleased. She looked, as I say, quite conscious of what the performance meant, and here, as with the Ruffs, and, in my opinion, all female birds (except, perhaps, where the relations of the sexes are reversed), the power seemed to lie in her hands. Probably—or possibly—owing to the earliness of the season, the feelings of neither sex are yet sufficiently advanced for pairing to take place.

April 21st.—Arrive at the usual time. From the “tchu-whai-ing” and the soft “choc-kerada”—that plaintive note of war—some birds it seems, are on the ground, and now, in flashes through the gloom, the white tail of one, here and there, and then its coal-black body appears. But, as the day breaks, all is silent, and not a bird visible. Nor do any come down again. It is another blank morning.

April 24th.—On the ground at 3.20 a.m., but nothing to record.

April 25th.—On arriving at near 5 a.m., I found several cocks on the ground, which made me regret not having come earlier—for I like to see things from their first beginnings. There was, now, more flying, for short distances, over the ground, and again alighting. This indeed was a feature, and, as the birds flew, they often uttered a deep note—“tchu-u-u”—which had a warning and threatening character. They did not, however, leap into the air. The war-dance, or frenzy, even in its incipient stage, was wanting.

A hen now flew into a small tree, close to where the cocks were, and I then saw that there were two more hens there on the ground. There was now some courtship, but it was of a very sluggish nature, nor did the presence of the hens have any marked effect upon the cocks, in regard to each other. There had been no fighting before, and there was none now, though, of course, there is always an idea of it. It is, so to speak, in the air, but does not—that is to say, I have not yet seen it—

come off. Two birds did, indeed, advance, in a slow way, and stand front to front, with their heads down, but nothing came of it; they did not make a pass. The little actual fighting which I have hitherto seen, and which has amounted to a few half-hearted passes and jumps against one another, has been when no hens were present. Such courting of the hens as now took place was the same as on previous occasions. The cock walked beside, or round, the hen, tilting himself in the way I have described, but springing, or "dancing," made no part of such display. The flying about the ground, indeed, was continued, on and off, by the cocks, the hens—some three or four in number—being also there; but it did not seem specially addressed to them. On the contrary, whenever a cock went specially to a hen there was nothing of it.

After awhile, another hen flew first into a small tree in the vicinity, then into the arena, and, later, another flew from there into such a tree, where she sat looking about. Things seemed only, as yet, beginning, and everything pointed to an interesting morning's observations, when, from the ridge where I generally watch, a shot was fired, and all, of course, was at an end. Happily no bird was hit—at least none seemed to be. It was a long stupid shot, having no other effect than to put an end to the interesting scene I was watching. There is no one to enforce the game-laws here and, for aught I know, it is the same all over Sweden. Owing to there having been nothing, day after day, I had come later than usual, and, finding the birds on the ground, sat down, without crossing it, in a place from which I had, perhaps, a better view. Had I been on the ridge, however, the shot might not have been fired. These are the kind of things that make the true field naturalist hate a gun; the bang of it, too, vulgarises everything—all poetry goes out of nature.

All now was over, for though the birds showed a good deal of disposition, in another half-hour, to resume their courtship, yet the shot had made them wild and unsettled. They flew about, both males and females, settling in different trees, rookling and "tchu-whai-ing," and one or two came down, here and there, but soon flew up again. One settled in a small fir, some twenty paces from where I sat, and rookled. The note commences with a "kroo, kroo, kroo," or "roo, roo, roo," and then comes the

full "give him his coppers, &c." To produce the sound, the bird lowers its head a little, and the throat is swelled, and reduced, and again swelled, on the bellows principle of alternate inflation and exhaustion, as I suppose. This gives it a curious undulatory appearance. When the fierce "tchu-whai" note is uttered—that is to say, just before it is—the Blackcock rears up with a little jerk, and gives a menacing flap—or it has that appearance—with its wings. Then comes the note, as does the trumpet of the Pheasant or the crow of the Cock. As the wings are flapped, their white under surface is revealed.

A hen also flew into a tree, equally near, and another into one not much farther off. Birds were all about, but their business of the morning had been murdered by that shot, and so had my observations. One cock came down, and jumped about a little by himself—a fly and then a spring or two—and this was the nearest approach to the "war-dance" that there was.

That I have come early seems evident. Just as I have to go, perhaps, things may be in full swing. Still I shall have seen the early stages, and in studying these nuptial activities, with a view to throwing light on their meaning and origin, this is important. Nothing that I have yet seen leads me to suppose that the courtship and pairing of the Blackcock differs, materially, from that of the Ruff. In this stage, indeed, I can say little, or nothing, in regard to any selection that may be exercised by the hen, but she has at least shown no signs of that passive surrender which naturalists who are opposed to the doctrine of sexual selection talk about. The fact that the cock, whatever he may do hereafter, is, at present, courting the hen after the ordinary manner of our own and other Pheasants, and not with that extraordinary dancing, or rather leaping, pantomime which, later, he seems to develop, is important, for a doubt is thereby raised whether he employs it for strictly courting purposes at all. If not, then, whatever he does employ it for, the question of sexual selection is not affected by it—except indirectly, and, in that way, perhaps, most importantly. In courting the hen, *now*, the male Blackcock comes close up to, and walks about her, precisely as the Pheasant does. On that occasion when I saw the "dance" performed, about the middle of May, in

Norway, no hen bird was visible,* and here, during its weak beginnings, the cocks were almost certainly by themselves. In the "dance," although the Blackcock certainly cuts a very extraordinary figure, yet there is no scientific exhibition of his plumage, bringing out all the points. He merely looks a frantic bird. It is also significant that, as I saw it performed in Norway, angry sounds, more or less answering to the "tchu-whai," which seems to be the note of challenge of one male to another, were all the while uttered; whereas the courting display proper, as I have yet seen it, is made in silence.

April 27th.—Almost a blank morning. Two birds only, after whirbling at one another from adjoining trees, for a long time, till quite late, past 7 a.m., flew down at last, not upon the arena, but amidst the scrub of undergrown fir-trees, skirting it. Here I could see them seeking for and advancing upon one another, and once they fought very slightly—over almost immediately. After this, they remained on the ground for some time, and then flew into the small trees.

April 29th.—On spot at 3.30 a.m. Rookling, &c., is all about, and I hear sounds—unmistakable, I think—as of birds fighting, in the darkness. With this comes the "choc-kerada," "choc, choc, kerade," that plaintive invitation to battle—though, as I say, of real battle I have seen nothing yet—also the prolonged "chorrrrrrrr" made by the cocks when they fly from place to place over the ground. Hens are also about, but I can see little, there is a mist on the ground, and it soon begins to rain. Not a bird to be seen, now, as it lightens. The fine rain may keep them away, but otherwise it is mild—comparatively warm, indeed.

At last a bird flies down, and then another, in different parts of the "moss." For some time they rookle, "tchu-whai," and fly about the ground; this last, however, being only at intervals. That they are defiant of each other is plainly evident, yet they keep their places, approximately, being at least fifty yards apart. A hen now flies into a small Scotch fir, somewhere between the two, and, shortly afterwards, down to one of them, alighting within a few yards of him. He immediately walks up to her

* None could have been near, for the "lek" was a lichen-covered granite surface, without cover.

and begins to court her. This he does in the way I have described before, but with this addition, or rather amplification—there is no new feature—*viz.*, that, having passed by her from behind, he continues to walk away, then turns, comes back, and does the same thing. It is evident that the hen has only to look in the direction in which he is walking, each time, after leaving her (*i. e.* straight before her), to have a full view of the white tail, which is displayed now to the best advantage. This was the principal point of interest. That every beauty of the plumage is well shown to the female seems now evident, but the spectacle of the courtship was a good deal spoilt, for me, by my being often unable to see the hen, her sober brown body—which is also smaller than the male's—getting hidden amongst the tufts of the heather; whenever I located her, however, as I did every now and then, she was situated as indicated by the cock's actions, and, once or twice, walking behind him, as he thus paced away from her, for she did not keep still. No further point of intimacy, however, was reached, and, after awhile, the hen flew away.

The conduct of the hen, therefore, this morning, was this. She first flies into a small fir-tree—not more than a shrub—growing amidst the heather of the assembly-ground, where the two defiant rivals are waiting, and midway between them. Then she flies to one of them, by whom she is courted, receives his attentions, but is not overpowered by them, and leaves. This is not what I understand by playing a passive part. On the contrary, she shows an active interest, though reserving her decision, and there is no indication of her being at either of the males' disposal. The power of invitation, permission, and veto, seems to lie with her; which reminds me that I have never yet heard it explained by those who have faith in the "indifference" of the female birds, why she comes to this particular class of assembly at all.

After the hen's departure, the two cocks continue to vaunt themselves, as before, but the martial spirit of the one that has been tentatively selected seems risen, in consequence, and, in a series of little flights, over the ground, and advances, upon it, he enters the territory of the other, who moves to meet him, in a similar spirit. The spectacle is now one of two timid boxers

pretending to be brave. Both seem about to leap, but draw back, in the moment of doing so. They are about to grapple, but do not grapple, to spar, but refrain from sparring. At last, fronting one another, with hardly six inches between them, they rookle in the most absurd manner, repeating the whole sentence, time after time, as though they were sitting in trees. It was really a ludicrous scene; yet, once, the bird whose territory had been invaded did really attack the other, taking him, I fancy, by surprise. But it was "like the lightning in the collied night," over almost before one can say "it lightens." After this, both cooled rapidly, and, before long, the invading bird went back to his own part of the arena, where he remained, for some little while, and then flew up into a tree. The other did not remain much longer, and though the morning is now fair, and not nearly so cold as it has been, the arena, at 6 o'clock, still remains empty.

It would seem, from this, that, like the Ruffs, each male Blackcock has his particular domain on the assembly-ground, though the size of this is in proportion to the much greater space of the whole. On the other mornings, too, the same birds, as I now make no doubt they are, have flown down into approximately the same areas. Yet it was a very different scene when my observations were interrupted by that shot, for then, in a small space, some half-dozen cocks were courting nearly as many hens. It is difficult to say why, most unluckily, on that particular morning, the coming-on disposition should have been so much more marked.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Bechstein's Bat (*Myotis bechsteini*) in the Isle of Wight.—I write by request of Mr. Percy Wadham, the well-known naturalist of Newport, to ask you to make this record. He caught two specimens of this Bat during the months of July and August last in a small copse of oak and fir, within one hundred yards of his own house. The first he killed with a stroke of his butterfly-net; the second he caught in the net and kept alive for some days. His friend Mr. Jeffery, taxidermist, of the same town, should have the credit of being the first to suppose that they were a rare species, and when Mr. Wadham sent me the female I was able to identify it without any doubt, being well acquainted with its nearest relatives. Mr. Jeffery took the following measurements of the female: Length of head and body, 1.75 in.; length of tail, 1.45 in.; length of ear, $\frac{7}{8}$ in. The male was somewhat larger. At first sight one would call this Bat "long-eared," though its ears are not nearly so long as in the species of that name; they are decidedly longer than in *nattereri*, *daubentoni*, and *mystacinus*. Hampshire claimed for many years to be the only British home of this species, but Millais records its occurrence in Oxfordshire, and Mr. Heneage Cocks in Berkshire (Zool. 1909, p. 154).—J. E. KELSALL (New Milton, Hants).

Artifices by Cat to secure its Prey.—It is well known that Stoats and Weasels will occasionally fascinate and cause their prey to approach by performing strange and unusual antics which have the effect of lulling suspicion and arousing the curiosity so highly developed in many wild animals. This peculiar habit has been described in detail and illustrated by Mr. J. G. Millais in his 'Mammals of Great Britain,' vol. ii. pp. 116 and 132. Possibly it is less commonly known that a similar device is employed by domesticated Cats, from which it may perhaps be inferred that wild members (*Felidæ*) also make use of this artifice. This is illustrated by the following observations made by the writer in Berwickshire:—During some very severe and snowy weather food for wild Pheasants was placed outside and close to a small covert about seventy yards from the house, and overlooked by several windows. More than twenty birds took advantage of this, and continued to visit the spot in the early mornings even

after the snow had entirely disappeared. A cinder-covered pathway runs through the grass not far from the feeding-place, and on this one morning was seen a black Cat surrounded by Pheasants—both cocks and hens—some of which occasionally approached to within two or three feet. All the birds—twenty-seven of which were counted at one time, this being a greater number than had been previously seen together—were watching the Cat with evidently the highest interest, stepping round and gradually drawing nearer and nearer. The object of their scrutiny lay quietly crouching on the ground, now and again turning over on her back and rolling from side to side, her paws and tail waving in the air. Then a sudden spring would be made at the nearest bird, but this meeting with no success caused only temporary alarm, and she was very soon once more as closely surrounded. This manoeuvre was several times repeated, the whole performance lasting altogether about half an hour after it was first observed. By this time the Cat had evidently tired of her unsuccessful attempts, and walked away quietly up the grassy slope, finally disappearing into the covert, still followed by a straggling line of fascinated Pheasants, a picture vividly suggesting a new version of the “Pied Piper.” It may be mentioned that the Cat in question was quite young, which may account for the absence of fatal results for the intended victims, supposing that the game itself did not provide sufficient charm and fascination. I am told that a Cat had been previously observed near the same place, and apparently being mobbed by a number of Pheasants, but no special notice was taken at the time of the occurrence. The hunting Cat is very generally considered one of the most destructive of the varied animals included in the list labelled “Vermin,” and the habit described above seems to record another black mark against an already damaged character.—D. M. A. BATE (Bassendean House, Gordon, Berwickshire).

The Queensland Dugong (*Halicore* sp.).* — Queensland differs from the other Australian States in having a rich and picturesque tropical region, with a coast-line of fifteen hundred miles. Amongst the inhabitants of Queensland waters the Dugong is the most remarkable. It has died out of, or been killed off in, almost every other part of the world, and if something protecting and encouraging be not done the time is approaching when even the Australian tropics

* According to Mr. Lydekker, “although it has been considered that the Dugong of the Red Sea and also the one found on the Australian coasts are specifically distinct from the Indian Dugong (*Halicore dugong*), this is extremely doubtful.”—ED.

will fail to yield a specimen. It once abounded along the northern and north-eastern coasts. Sixty years ago it was hunted by the white man for sport; fifty years ago a belief in the curative properties of its oil was propagated, and sport and money-making were combined. All the time and for ages before it was killed by the aborigines, and eaten as a choice article of food. It would have been extinct, or almost extinct, before now had not the Queensland Government legislated to protect it during certain seasons. The Dugong wears a weird, misshapen look when seen in the shallow coastal waters, or on the grass-grown bottoms at the mouths of rivers entering the sea. The absence of hind limbs creates an impression of deformity, an impression which is deepened by the apparent helplessness of the frail flippers. The animal bulks largely in comparison with the living things ordinarily seen in its vicinity. It sometimes reaches 12 ft. or 16 ft. in length, and weighs between 10 and 12 cwt. Eight or ten feet is a common size, and 4 to 5 cwt. a medium weight. Its movements are laboured and sluggish. It crushes the short reeds with its broad molars. In the male the incisors become the formidable tusks. The blacks and some whites tell stories of the Dugong climbing on to the land and browsing along river-banks in the moonlight. Uncanny incidents attach to these legends, but though seemingly corroborative details are forthcoming, the stories must remain in the category of myths. The sluggish beasts have quite enough to do to make a living in their native element without adventuring on the mainland or on dry land anywhere. And if they were set down any distance from the water their frail flippers would be weak supports for the journey back. In the stories, however, there is sometimes an element of romance. The affection of the female Dugong for its young is raised by some to the rank of a special virtue. Many examples of what looks like affection are certainly forthcoming, but as often as not the cow and bull Dugong make off when danger threatens, leaving the calf to extricate itself as best it can. Seldom do they exhibit any of the blind fury of the mother Whale in similar circumstances. The mother Dugong may for a little time hang about well out of reach of harm in expectation that the calf will come along, but the wound of severance heals quickly, and browsing is renewed with freshened appetite. Occasions occur when mother and calf appear inseparable, the mother staying alongside the harpooned calf till she also has been harpooned. But such incidents are not frequent, and when they occur there are grounds for attributing the mother's conduct to dulness of apprehension rather than to affection. There are authenticated cases, however, of a mother following a captured calf a long distance, and

her bleats of complaint, as well as the appeal in her eyes, have affected the fishermen's nerves. Natives of the Malay Islands make a decoction of Dugong juices, which they term "Dugong's tears," and sell as love charms, thus indicating a Malay belief in the tenderness of the animal's affection. Thirty years ago Queensland looked to the Dugong as a coming source of national wealth. Great herds of them abounded in the waters off the northern coast, and occasionally spread as far down as Moreton Bay. Fisheries were established on a considerable scale. Companies for boiling down and canning Dugong were started at Wilde Bay and Hervey's Bay under encouraging auspices, but through a number of preventible causes the industry was allowed to languish. Dugong bacon may be purchased in a few shops along the Queensland coast. The blacks like it, and when prepared in a fashion of their own the Chinese are fond of it. The fresh meat, roasted or grilled, is acceptable to most men if they are hungry. It tastes like pork, but with a fishy flavour. Of course the way it is prepared has a lot to do with its acceptableness as food. Many people along the coast, when Dugong was commonly sold, have eaten it for pork without suspicion. The common method of preparation is to fry it in its own oil or salt, and preserve it as hams or bacon. The curative properties of the oil were first brought before the world about the year 1855. The therapeutic effects were glowingly described. The oil was classed as "emollient and solvent." Dr. Hobbs, Health Officer at Moreton Bay, wrote:—"In its pure state it may be taken into the most sensitive stomach. It is sweet and palatable. As a restorative remedy it may be taken as food, and many ounces consumed almost imperceptibly every day, thus furnishing the system with the requisite amount of carbon for its daily oxidation." He and other Queensland medical men employed it in practice, and for a time all Australia regarded it as a medical boon. Fishing stations were formed at St. Helena; samples of oil and meat were sent abroad, and medals and other recognitions won at various exhibitions. Extract of Dugong is sold at present by Sydney chemists in the forms of oil, lard, and ointment, and a London West End physician is now using the oil in his practice.—THE LONDON CORRESPONDENT OF THE 'NORTH QUEENSLAND HERALD' (70 A, Basinghall Street, E.C.).

AVES.

Crossbills (*Loxia curvirostra*) in Hants.—Several intelligent observers have met with these birds recently (December, 1909) on the south side of the New Forest.—J. E. KELSALL (New Milton, Hants).

Zool. 4th ser. vol. XIV., January, 1910.

Lapland Bunting near Great Yarmouth.—On Oct. 15th, 1909, in the vicinity of Yarmouth, a Lapland Bunting (*Calcarius lapponicus*) was taken alive by means of a clap-net. Two others have also been reported.—B. DYE (Great Yarmouth).

The Honey-Buzzard near Yarmouth.—The Honey-Buzzard (*Pernis apivorus*) has again appeared in one at least of the Eastern Counties. A specimen was obtained in the second week in October, 1909, at Haddiscoe, about seven miles south-west of Great Yarmouth. It is now in the possession of our local taxidermist, Mr. W. Lowne, who informs me that the prevailing colour of the bird is light umber-brown, and differs considerably from the dark varieties obtained in the autumn of last year.—B. DYE (Great Yarmouth).

Black-tailed Godwits in Co. Cork.—It may interest some readers of 'The Zoologist' to learn that in December, 1908, a small flock of Black-tailed Godwits (*Limosa belgica*) visited Cork Harbour (about nine or ten birds), and were seen on the mud-banks off Blackrock, where my friend Mr. W. B. Barrington shot a fine specimen. And this season another small flock visited our south coast, one being shot near Youghal Harbour, and Mr. Barrington had the pleasure, in October, of seeing about a dozen birds on the very same mud-banks off Blackrock where he had observed them previously. One of this flock was obtained by a friend of his, and the flock was afterwards seen on several occasions feeding on the banks. These birds are of very rare occurrence on our west coast, and although regularly punt-shooting on the Moy Estuary, Killala Bay, from 1858 up to 1908, only three or four individuals have come under my notice, and only one specimen shot by me, near Bartragh on March 6th, 1876. But I have heard of two others being shot, and have seen the birds; one was shot on the tidal part of the Moy in May, 1863, and was nearly in perfect summer plumage, and another on Sept. 3rd, 1881. In every instance, except the pair I saw in June, 1878 (which were in summer plumage), all were solitary birds in company of Bar-tailed Godwits.—ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

The Sir Henry Boynton Collection of Birds: a Valuable Addition to the Hull Museum.—Through the kindness of Mr. and Mrs. Wickham Boynton, the collection of birds formed by the late Sir Henry Boynton, which for many years has been exhibited in the large room at Burton Agnes Hall, has been placed in the Municipal Museum at Hull. As all ornithologists are aware, Sir Henry's collection of birds, principally obtained by his own gun, was one of unusual interest and importance, and contains many great rarities. There are over two

hundred cases in all, and besides being valuable by reason of the scarcity of the specimens, the collection is interesting from the fact that in many cases both sexes of birds are represented, and in some instances there are also the young. Each case has been exceedingly well set up, and the whole forms a collection such as is rarely seen together. In addition to this the Hull Museum has also recently acquired the collection of birds (about seventy cases) formed by Mr. Riley Fortune, F.Z.S., the well-known ornithologist. This latter consists principally of Yorkshire specimens, and fortunately serves well to fill in the gaps in the Sir Henry Boynton Collection. These, together with the Pease Collection already in the Museum, will enable the authorities at Hull to have a display of birds such as will be difficult to beat in any Northern Museum.

PISCES.

The Queensland "Barramundi."—The northern rivers of Queensland have a first-class fresh-water sporting fish, the Giant Perch, popularly known as the "Barramundi" (*Lates calcarifer*). This fish attains a length of four to five feet, and a weight of over sixty pounds. This fine fish, known in India as the Cock-up or Nair-fish, occurs also in China, and has been seen in the Singapore fish-market. In aspect and habits of feeding the "Barramundi" suggests the English Bass. So greatly is this fish esteemed for the table that regular supplies are now being despatched to Sydney from Queensland, where tons weight are being disposed of from 6*d.* to 8*d.* per lb. THE LONDON CORRESPONDENT OF THE 'NORTH QUEENSLAND HERALD' (70A, Basinghall Street, E.C.).

OBITUARY.

DR. RICHARD BOWDLER SHARPE, LL.D.

THE announcement of the death of Dr. RICHARD BOWDLER SHARPE, at the age of sixty-two, will cause the greatest regret among the wide circle of his friends and admirers in all parts of the world; but his loss will be more especially felt and mourned by ornithologists, for they can best appreciate his great talents and extraordinary knowledge of Birds. On December 16th he attended the monthly dinner and meeting of the British Ornithologists' Club, which he founded in 1892, and was then in his usual health and good spirits,

but while returning to his house at Chiswick he appears to have contracted a severe chill, which rapidly developed into pleuropneumonia, and ended fatally on December 25th.

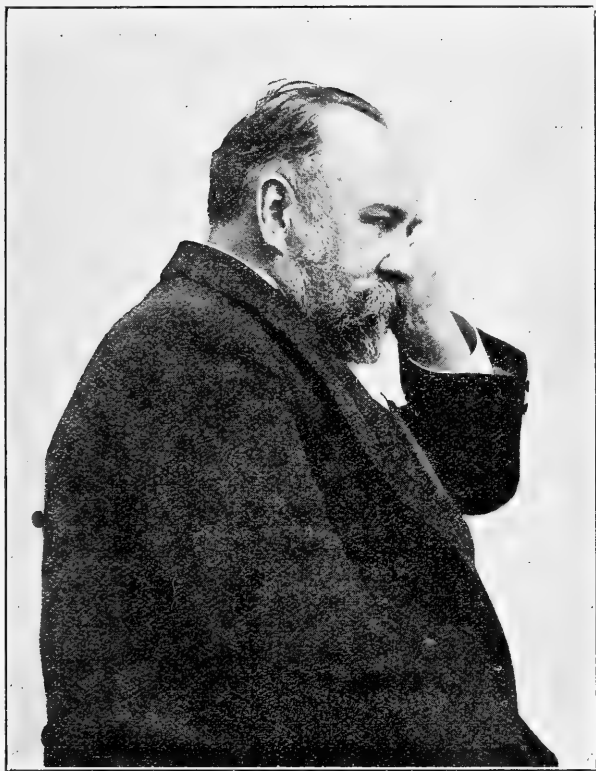
He was born on November 22nd, 1847, and was the eldest son of the late Thomas Bowdler Sharpe, well known as the publisher of 'Sharpe's London Magazine.' He early displayed a great taste for natural history, more especially for birds and insects, and as a boy spent much of his time in the company of William Briggs, a naturalist of considerable skill, who helped him to form a collection of mounted British Birds, which was eventually presented to the British Museum.

He was educated at Peterborough (King's Scholar) and Loughborough Grammar Schools, and subsequently entered the publishing-house of Messrs. W. H. Smith & Son in 1863, and worked for a time with the late Mr. Bernard Quaritch. In 1867 he was appointed Librarian to the Zoological Society of London, and retained that post until 1872. On the death of George Robert Gray he entered the service of the Trustees of the British Museum, and was appointed Senior Assistant in the Department of Zoology on September 11th, 1872, a post which he retained till November, 1895, when he was promoted to be Assistant-Keeper in charge of the Vertebrate Section.

While Librarian to the Zoological Society he began to publish some of his work, including a catalogue of his private collection of African Birds and his splendid 'Monograph of the Kingfishers,' a work which at once established his reputation as an ornithologist of exceptional ability. He also conceived, and in partnership with Mr. H. E. Dresser commenced to publish, a great serial work on the 'Birds of Europe,' but after fifteen parts had been issued he was obliged, owing to other important engagements, to relinquish his share of the work, and the remaining parts were completed by Mr. Dresser alone. Shortly after his appointment to the British Museum he commenced to write the great work of his life, 'The Catalogue of the Birds in the British Museum.'

No one of the present generation who visits the Bird Room at the Natural History Museum can have any conception of the difficulties under which work was carried on in the old days at the British Museum, the underground dungeons which were used as workrooms being not only very small but very insufficiently lighted. The first volume of this Catalogue, containing the Birds of Prey, was completed and published by the Trustees in 1874, and the whole work, contained

in twenty-seven thick octavo volumes, took twenty-four years to finish, having been only completed in 1895. Eleven different specialists took part in this mighty undertaking; Dr. Sharpe himself contributed no fewer than eleven whole volumes and portions of three others, and edited or assisted in the preparation of the remainder, a feat of which he was justly proud. During these years he also found time to publish a number of important works, such as his 'Monograph of the Swallows' (commenced with Mr. C. W. Wyatt), and to complete the



'Birds of Asia,' 'Birds of New Guinea,' and 'Monograph of the Humming-Birds,' three great folio works by Gould, which had been left unfinished at the time of his death. He also contributed numbers of important memoirs and papers to various scientific periodicals, more especially to the 'Ibis,' 'Proceedings' of the Zoological Society, and 'Journal' of the Linnean Society.

In 1884 Dr. Sharpe was sent to India to superintend the package

and transport of the great collection of Indian birds and mammals which had been presented to the British Museum by Mr. A. O. Hume. During his absence the writer was placed in charge of the Bird Room, and since that date had been closely associated with Dr. Sharpe up to the time of his death, and had co-operated with him in forming the now unrivalled collection of Birds and Eggs at the Natural History Museum.

Between 1899 and 1909 he compiled a 'Hand-List of the Genera and Species of Birds,' which was published by the Trustees in five volumes, a most laborious task, in which he was largely helped by his faithful and devoted attendant, Charles Chubb, who had so ably assisted him in all his work during the last twenty-five years.

The second volume of the 'History of the Collections' contained in the Natural History Departments of the British Museum appeared in 1906, and of this Dr. Sharpe wrote the Section "Birds," pp. 79-515. This very valuable contribution contains many interesting details respecting those who have helped to form the great collection of Birds in the Natural History Museum, and particulars concerning them which otherwise would have been lost and forgotten, as many of the facts were based on his personal knowledge of men long since dead and gone. With the death of Dr. Sharpe a link is lost between the modern school of ornithologists and the little band who originally founded the British Ornithologists' Union. He knew them all, and his personal reminiscences extending over more than forty years were always interesting and often most entertaining. His extraordinary memory, which enabled him to name collections of birds off-hand with tolerable accuracy, and by merely glancing over them to tell approximately where they came from, was truly remarkable, especially before his health began to fail.

Dr. Sharpe was immensely popular, and justly so, among ornithologists all over the world, and was elected President of Section A at the Ornithologists' Congress held at Budapest in 1891, and at Paris in 1900; he was also elected President when the Congress met in London in 1905. He was Honorary LL.D. of the University of Aberdeen, a Fellow of the Linnean and Zoological Societies, a Member of the British Ornithologists' Union, and a recipient of the Gold Medal for Science bestowed in 1891 by H.I.M. the Emperor of Austria.

W. R. OGILVIE-GRANT.

NOTICES OF NEW BOOKS.

Man and Nature on Tidal Waters. By ARTHUR H. PATTERSON.
Methuen & Co.

THIS is the fourth volume written by Mr. Patterson on the fauna of his native district which he knows so well ; in fact, he has now become the natural historian of East Norfolk. The present volume, however, differs from its predecessors in being mainly devoted to reminiscences of those humble folk who, though born naturalists and sportsmen, know it not, and choose to acquire a barely living wage by occupations which link them with nature and the pursuit and familiarity of animal life. These somewhat primitive and peculiar people, who might well be called *Homo breydonensis*, are in many pursuits fast dying out, their occupation gone, and the survivors themselves almost relegated to the "scrap-heap." Mr. Patterson has had a long personal experience of this hardy Yarmouth race—smelters, shrimpers, eel-fishers, gunners, mussel-dredgers, trawlers, and mackerel and herring catchers—and his reminiscences of them, and the statements he has obtained from them make this book a very "human document." Interspersed with the yarns of these delightful waifs and strays—who belong to the environment as much as the other animal life—are many bionomical observations of both bird and fish, told with that simplicity of fact which only long familiarity inspires. How much more of this first-hand knowledge is probably buried with these rough naturalists who neither understood themselves nor were recognized by others !

Mr. Patterson has done his work well ; if this volume is perhaps the least purely zoological of his series, in a literary sense it is by far the best. We commenced his book in the early evening ; it held us, and we went to bed that night far beyond our usual hour. We know these tidal waters well ; fifty years ago we first handled a gun, and that on Breydon ; and though for many years the wild district has become to us only as a memory, these pages have reproduced the old scenes, the animal life and the old human characteristics. It is not every writer who can do this with success : Mr. Patterson's books are as representative of Yarmouth as is the Herring.

Indian Insect Life ; a Manual of the Insects of the Plains (Tropical India). By H. MAXWELL-LEFROY, M.A., F.Z.S., &c.
Assisted by F. M. HOWLETT, B.A., &c. W. Thacker & Co.

THIS massive volume marks the untiring energy of Mr. Maxwell-Lefroy, the chief entomologist of the well-known Agricultural Research Institute at Pusa, Bengal. Many beautiful publications have served to illustrate some of the gorgeous insects of India, but this is the first work to treat the subject with any degree of completeness, so far as all orders are concerned. The volumes devoted to the Insecta, in the series relating to the "Fauna of British India," will naturally, when completed, form a "last word" to date, but their complete appearance will not be for some years. In this volume we must not expect infallibility in the extensive field surveyed by Mr. Lefroy, but we do in these pages discover the best introduction to the subject, very much original information, and a distinct and valuable addition to Oriental entomology.

As regards "Instinct and Habit," the author's views appear to lean to the Cartesian estimate, and as being more or less automatic. On the subject of classification, that vexed controversy in which proposals are defended as axioms by their proposers, we quite agree with the remark of Mr. Lefroy, that "the most diverse views prevail, and there is no standard classification that is or can be universally employed, even if it be admittedly not academically accurate, but sufficiently so for practical purposes." If this is true of taxonomy, what may not be said of some theoretical conclusions? and we are not at all surprised, nay thankful, that on the subject of "Mimicry" we read:—"The sincere student with a profound faith in human nature may be cautioned against accepting any conclusions or facts not based on observation of insects in their natural conditions; the search for explanations of insect-colouring has almost rendered the whole subject ridiculous, since conclusions have been drawn from museum specimens, which have no relation to the lives of insects."

The excellent illustrations in this volume are mainly contributed by the artist staff of the Pusa Institute, artists who are natives of India, trained in art schools of that country; in fact, the whole volume is the work of, and a credit to, the press of our Indian Empire.

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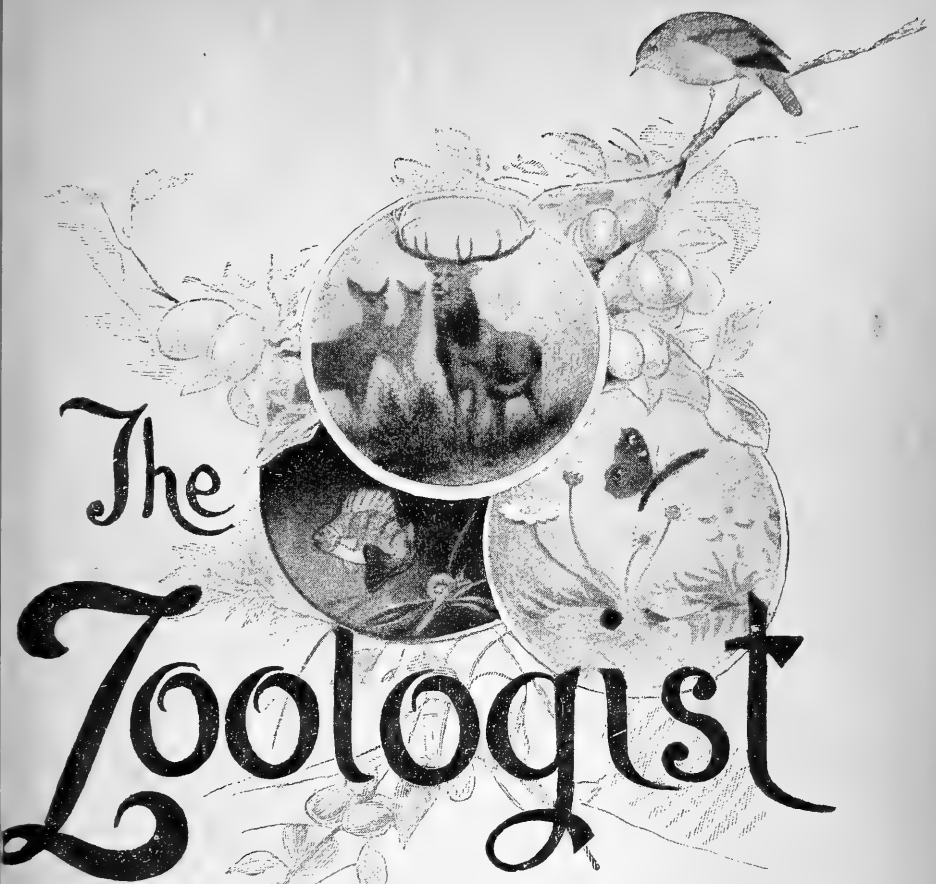
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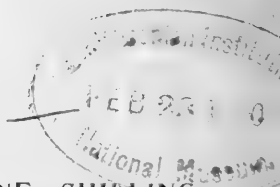
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THE ZOOLOGIST

No. 824.—*February, 1910.*

SUMMER IN LLEYN, WITH SOME OTHER NOTES ON THE BIRDS OF THE DISTRICT.

BY O. V. APLIN, F.L.S.

A PUFFIN colony is always interesting in the breeding season, but I think that at no other time is it so full of life and interest as just when the young are hatched and still in the holes. It was partly to study the Puffins at that stage, and partly to see the hills and cliffs of Lleyrn when they were ablaze with the bell-heather in blossom, that I made my way down to that delectable country in the last week in July, 1905, a season when for good reasons the field ornithologist usually avoids the sea-coast places which cater for visitors. The Puffin-warren on St. Tudwal's islands is a very large one, and considering the small size of the islands the crowds of birds one sees is extraordinary. The warren is an old one. Pennant, who visited the islands in the course of his tours (1773-6), mentions that there was a small chapel on the larger island, of which a tradition still exists, and that the then present inhabitants were sheep, rabbits, and, in the season, Puffins. He does not refer to the old name Mer-cross belonging to one of the islands, and marked on Speed's and Camden's maps. The colony on the eastern island is really enormous; how many thousands of Puffins there are it is impossible to tell. Take, for instance, a piece of ground a chain wide and three or four chains long, with Puffins sitting about a

foot apart all over it. How would that work out? Then add those sitting thickly on the sea just below, those underground, and those coming and going, and this would be only a small part of the whole of the Puffins on that island. There are also great numbers on the western island. There are thousands of Puffins on Ynys Gwylan fawr. On the north-west side they sat as thickly as they do on St. Tudwal's, but the island is much smaller; still they form a big colony. On Ynys Gwylan fach there is a fairly large number; but I do not think they like this island, because the thick growth of scurvy-grass keeps the peaty soil very cold and damp, even in a dry season. I found this year that Puffins breed on the mainland between Trwyn-y-Penrhyn and Ogof Lwyd, where the cliff-top is covered with short turf and sea-pink. They nest in old rabbit-holes in the slope or in the earth bank raised along the edge of the cliff; the holes seemed to be of great depth. Others went into holes part of the way down the cliff. The birds were much more shy than those on the islands, and had I not been attracted by the peculiar sour smell of a warren and the wash and bits of small fish lying about I might have overlooked the fact that they were breeding. I soon noticed some loaded birds flying along the cliff, and then out in wide circles over the sea, and then coming in again. I had to go away to a little distance before I could watch the birds in. About fifty birds sat in a cluster on the sea down below, and there were a few others scattered about. I extracted some young from holes on the islands as big as or rather bigger than a Swan's egg. This was including the down, which stands straight up, and is an inch and a half long or more in places. At this stage the head and upper neck and throat are nearly black; body dull blackish grey; belly patch pure white; between the throat and the white of the belly a band of lighter grey; bill dull lead-grey; feet dark pinkish grey. Another rather larger bird, with wing-quills just appearing, had the mantle greyer. The young are active on their feet, and always sought cover. They ran in under us when we were stooping down, and when put at the entrance of the holes ran in like rats. When handled the young frequently uttered a piping "jerp." The nests, when there was any nest, were chiefly formed of coarse grass, grass-roots, and some old quills. Some

of the St. Tudwal's Puffins (according to the man who knows the islands best, and in whose company I have visited them for several years past) do not leave until the middle of September, although most of them go by the middle of August.* But the young must grow very fast, and no wonder when we consider the amount of fish that is brought to them. The fish-fry ("seel") I saw brought in was of various sizes, from two or three inches long up to six inches in some cases, but most of it seemed to be about three inches long. With the glass I could make out that some of it was Mackerel; there were bits of this, too, lying about. Sometimes three good big "seel" were brought, all on one side of the bird's bill; in other cases perhaps a thick bunch of small ones hanging from both sides—six or seven certainly, and possibly more. The "seel" were always held, as far as I could see, just behind the gills, so that the head was on one side and the body and tail on the other. When a Puffin loaded with fish drops on the land it almost always bustles into its hole with ludicrous haste—always when alighting among a crowd of birds—fearing robbery perhaps, though I saw no attempt at it. At other times they will stand still for a while before going in, and sometimes they pitch a yard or two from the hole and walk or run to it; but usually they pitch at the mouth of the hole and go in at once. If you are standing too near a hole the bird does not alight, but flies away again, describing a wide circle over the sea, and comes back past the place. It will sometimes do this as often as half a dozen times, always flying the same circle and arriving from the same direction. Then they either give it up and settle on the sea, or, overcoming their distrust, drop and run into the hole. When the Puffin rises from the land it first puts its feet together under it, not in an attitude of prayer, but rather as with "unctuous palms," but almost at once extends them at the side of the tail, and then gathers them (spread) at the sides of and partly under the tail. When alighting it straddles them widely. There was very little sound about the warren. Sometimes I heard underground a long-drawn, very grating "owk" or "ow"; or perhaps a long-drawn "ooooo," somewhat like one of the nocturnal calls of the cat, *i. e.* the

* In 1906 the keeper of the lighthouse wrote that they "left about the 15th August, rather earlier than usual."

long "no," from a hole after a bird had gone in with fish, and was perhaps crooning over the young one. There is a considerable variation in the appearance of the old Puffins. In some the legs are orange-coloured, and the back a hoary greyish black; these birds are smaller than some others. In the bigger-looking birds the legs are of a full vermilion-red, and the back is blacker. As to the grey on the face, one sees at this season all degrees between its presence in full degree and its total absence.

One thing which must strike an observer who visits a Puffin-warren at this season is the number of birds he will see standing about idle, with apparently nothing to do, even at this the most busy time of the Puffin's year.* It may fairly be advanced, it is true, that the Puffin which brings to its young one, when it does come back, such a good weight of solid fish has no need to be coming and going all day long like a Blue Tit, which brings at each visit nothing more satisfying than a flabby caterpillar or an unsubstantial fly. We may even allow that the parent Puffins who brought their fluffy young ones nice bunches of fish of this morning's catching may fairly be entitled to be now (11 a.m.) idle, and to pass the day, like a lot of longshore fishermen, sitting in a row (with a careful eye on the offing), until possibly, as evening comes on, the demands of the growing ball of down make it necessary to once more go a-fishing. But even if we were to go further, and even allow or suppose that each parent has only got to bring a bunch of fish once in a day (and, indeed, this would amount to a fair allowance), and could then go off duty, it would hardly seem to account for the presence of all these idle-looking Puffins. But scanning the serried ranks of the birds with the glasses I was struck with the difference in colouring and size mentioned above. And these smaller, duller birds, if they are really as yet immature and non-breeders, would solve the question of why so many Puffins in the breeding season always seem to be standing all the day idle. But young or old, there they stand in crowds, immovable, silent, Sphinx-like, staring out to sea, or turning a

* It was Edward Pugh who wrote of Priestholm in 1804 as "literally half covered with those indolent birds called Puffins." In those days Puffins were pickled and put into barrels of twelve inches long, which sold for three or four shillings each ('Cambria Depicta').

hard, cold eye on you if you approach them too closely. Content to have posed the whole world of bird-men with the great Puffin-puzzle. How without dropping the five fishes in their beak do they catch and stow away number six in that curious wrinkled "gape"? I know no pleasanter way of smoking a pipe than sitting on one of these breezy islands and pondering on this, and the other great question, Where do all the Puffins go to pass the winter?

"Amusive birds! say where your hid retreat,
When the frost rages and the tempests beat?"

Along the south coast between the foot of Rhiw and Aberdaron is a strip of rich country with good farms, but still no trees worth the name. There are hedgerows to some extent, but they are made up chiefly of gorse, bracken, and brambles. Some thorns let to go big and elders shelter the farms; they are big enough to attract the Green Woodpecker which I saw there, though it is much more common on the north coast about Carog, where there are low woods. A few hedgerow birds may be seen—Chaffinches, Greenfinches, Hedge-Sparrows, Whitethroats, and plenty of Linnets and Corn and Yellow Buntings. The bay between Trwyn-y-Penrhyn and Mynydd Penarfynydd is a beautiful one, with cliffs which, green and sloping for nearly all their height, have a richer soil than those of Aberdaron bay, and so are more bushed and bird-haunted and flowery, *Geranium sanguineum* being the most showy flower. The sand or clay of the Aberdaron cliffs is very poor and cold, and grows the poorest of floras; they are also weathering and falling away a good deal, which the eastern bay cliffs are not.

Just as in May the gorse makes yellow the prevailing colour here, so in summer purple is dominant. These Llyn cliffs and headlands are gorgeous on a bright day. Purple in the distance, but near at hand broken up into the purple of the bell-heather, yellow dwarf gorse, and deep green bracken. The air is full of a honied scent, and butterflies are swarming—Graylings, Meadow Browns, Gatekeepers, and Blues chiefly; there are a good many Fritillaries, too (I secured a "Dark Green"), and Painted Ladies, but the rather local Graylings were certainly *the* butterfly feature. On all the higher parts of Llyn—even Myntho Common, the

coldest, bleakest part of the coach journey—purple is the brightening colour, and when this (as in the Nant of the Horan) caps a wooded slope the effect is beyond words. The masses of ragwort sometimes make the roadsides yellow. Broad stretches of glowing purple light up Rhiw, Rhos Hirwaen, and similar places, which are so brown and gloomy in spring. And there are purple splashes on the hedge-banks, where the large harebells hardly disturb the general effect; and the dull purple of the hemp-agrimony is a feature of the roadsides on the lower ground. The great masses of bracken have now turned a deep or “prophet’s” green, and the barley is ripening, though oats are green. It is quite a barley country, and in some respects does not seem much altered since the days of Camden, who wrote of “Llein, which runneth forth with a narrow and even by-land, having larger and more open fields than the rest of the country, and the same yielding Barley most plenteously.” You can still here get barley bread. Among the floral beauties and rarities of the cliffs I found an everlasting pea (the *Lathyrus sylvaticus*) in great masses. I know, too, where to climb down the rocks and sit where the sea-spleenwort grows in profusion.

The Choughs about the Nevin bird-rock have, I believe, become almost extinct now. When I wrote my description of the rock a few years ago I refrained from mentioning them. But now they are gone no harm can be done by placing on record their former status. At the end of May, 1902, I spent the greater part of two days at the rock. On the southern side of it there is a rounded green-topped cliff frequented by Kittiwakes, Guillemots, and Razorbills, and on the southern side of that the Choughs were going into the cliff. It was not easy to see much of them, although I supposed they were feeding young. They came over the top and shot down almost perpendicularly, and then went in to the cliff below where I stood. Presently they came out, beat up the cliff-face, and flew away inland. I saw four at the same time, and came to the conclusion that there were four pairs. I saw another pair which were said to have young in a quarry in the mountain (Gwyliwr), a little back from the coast between the rock and Nevin. A pair of Peregrines were breeding in the rock at that time. The eyrie was in about the middle of the rock; in a square-shaped hollow

or small cavern, with sheer rock below and overhanging cliff above. The floor appeared to be flat, with a good growth of herbage and dark green grass in front, and two big stones in the foreground. I several times saw a bird go in, and it always went behind the stones. They brought food from inland. They were silent when they first appeared wheeling in front of the rock, but on and after catching sight of me they kept up a loud "quayk, quayk, quayk" when flying, and also when settled on a bit of rock. The male was warmly coloured underneath. They often struck at Herring-Gulls, once at a Chough, once at a Jackdaw, and twice at Cormorants, causing great outcries from the birds attacked, but doing no damage. It was a fine sight to see them close their wings, turn a little sideways, and shoot down. Cormorants were quite happily sitting on their nests just above the eyrie. I doubt if the Falcons often molest the birds breeding around them. It was very fine to hear the deep, reedy, bassoon-like "howk" of the Cormorants, repeated many times, and very quickly at the finish. This cry is uttered when the birds fly in to the cliff, or wheel past the face of the rock. I saw Cormorants often fetch sticks, &c., from disused (or temporarily vacated?) nests, and bring them to the nest on which their mates were sitting, seeming pleased and proud of what they had done, and trumpeting loudly. Other birds were lying down and bending their necks backwards, until their upper mandible rested on their lower back; they then shuffled their wings. A most curious sight. In the afternoon Cormorants seemed to enjoy flying round in great curves in front of the rock, chiefly on motionless outstretched wings. They go across the land to feed, doubtless to the shallows of the sandy south coast. Fifteen species of birds frequented the rock, and from observation and information I believe they all bred there, *viz.* Peregrine, Kestrel, Crow, Chough, Jackdaw, Rock-Pipit, Wren, Barn-Owl, Herring-Gull, Kittiwake, Shag, Cormorant, Guillemot, Razorbill, and a small unidentified blue Pigeon. It only required a few Puffins to make as fine a rock-bird station as any in the British Islands. I saw all the birds except the Owl.

To return to the summer of 1905. The young Choughs from the nest at Porth Felen got off again this year, as they always do, the nest being quite inaccessible. It was probably these

birds that I saw on Mynydd Mawr. On a fine hot morning (28th) a Chough was turning over sheep-droppings among the heather-tufts in a search for insects, and now and then crying "k'chare." At the top I surprised four together, and as I rested there another flew past close to me. Choughs are *too* tame. They appear to go some distance to feed. Returning from a long hot tramp that afternoon, I had paused, as one must, at the old water-mill to gaze down into the cool depths of the ivied wheel-case, where the Dipper has bred, and listen to the splash, splash of this ancient back-over-shot wheel (the only one I remember seeing), when the familiar ringing cry came down, and two Choughs passed over high up, and going towards Mynydd Annelog, whence eggs were sent to Wilmot as long ago as 1846 ('*Ootheca Wolleyana*'). Another day, before breakfast, a pair came along the coast, over the church, and headed for the same place, mobbed on the way by four Jackdaws. From a boat when under Penrhyn Du I saw a little place in the cliff which looked as if a hawk had nested*—a little shelf part of the way down a perpendicular crevice—and was told that in the spring a pair of Choughs came and tried it; they appear to have found it unsuitable, but bred that year on Llanbedrog Head, not far away. One at least of the young ones had been taken, and was then flying about by the quay at Abersoch. It was absurdly tame, biting at your fingers, and afforded a nice opportunity of studying the most graceful flight of this beautiful bird. I saw a pair on Pen Cilan. One pair there had their eggs taken, and the other pair, which used to breed in a cave, do not appear to have nested there this year. I watched a pair on Penrhyn Du. One of them sat preening itself on a bit of old rail in one of the cross-banks just outside the big bank separating the heathery cliff top, which is open to sheep, from the partly cultivated land inside. It was a well-used spot, and "castings" lying on the ground showed that the birds had been eating barley already. I have seen birds there in former years. Having picked up some quills and enjoyed the unusual experience of cleaning my pipe out with a Chough's primary while I watched the birds feeding and flitting about a pasture, I moved on. There were many Stonechats about wherever there were any bushes; some Pee-

* A few years ago a Merlin did so close here.

wits and Curlews. The cries of the latter are very soft now, "curlewee"; and I heard also the mellow flute-like migratory call, "klee-tler-wer," which I have sometimes heard from birds passing over at night in Oxfordshire. Passing Pistyll Cim (where some Herring-Gulls nest on the cliff), I drank of the "sweet water" of the clear spring, where such a lot of bog-pimpernel was flowering, and, rounding the stony-topped Trwyn-yr-Wylfa where you almost always see Shags, descended to Porth Caered, whose sweeping slopes drop to the sandy beach, and are covered with short bracken seared by sun and salt winds, and varied here and there by a few tall mullein plants. The bracken is followed by marram-grown sands, and a low bluff separates this from the sandy shore. How few birds one sees in these bleak, wintry-looking spots! From here I made my way to the undercliff beneath the fearful precipice of Pared Mawr—an eerie spot that evening. A few Herring-Gulls had not yet got their young away (July 25th). There were two in a nest on a pinnacle of rock, and I got close to another (full-fledged) on a ledge. The old Gulls made curving swoops over me with a swish of wings and angry cries of "ag-ag-ag" and "kiow" as I stood under the mighty rock-wall, with Cilan to the west almost hidden and looming mysteriously out of the white mist creeping in from the sea on the soft south air. Down below the sea was so clear that all the stones at the bottom and the brown seaweed could be seen clearly. The cries of a pair of Kestrels (common birds along the cliffs I am glad to say) rang out with surprising loudness. But Cilan was soon quite blotted out, and I thought it advisable to get out of the rocks, for the sea-mists of Lleyn are sometimes inconveniently thick. A Corn-Crake was calling as I walked home. A clutch of eight eggs of this bird, quite fresh, was waiting for me. They had been mown out of hay-grass a day or two before the 24th—rather a late date. Failing a knowledge of the English name, it was well described as "a brown collar bird, and it ues to sing at night."

But to go back to my notes on Gulls. On the cliff at St. Tudwal's Islands on the 25th there were only two nearly full-grown young ones. On the 27th I landed on Ynys Gwylan fawr and fach, and found on both many adult Herring-Gulls, which breed there in numbers. They were almost as noisy as in spring,

but I could not see any late young ones, nor indeed was there a young bird of any age in sight on the wing or otherwise, and, although of course a young one or so might have been hidden in the rocks, it was quite certain that practically all the young were gone. There is a part of the low coast of Merioneth across the bay where all the early summer at all events numbers of immature (and some adult) Herring-Gulls are always to be found, and as none are bred on that coast it is reasonable to suppose that the young birds bred in Lleyn resort at once, as soon as they are strong on the wing, to the sands and adjacent marshes of Merioneth, and there pass their earlier years. I have previously remarked on the comparative scarcity of immature Herring-Gulls in Lleyn. I saw a very few brown young on the wing about the deep cliff-enclosed inlet called Ogof Lwyd, where there is a stack a little way out, on which, however, I did not think any birds bred. About a score of Kittiwakes (their greenish beaks noticeable) sat on steps of the steep black cliff by the small deep cave at the south-east corner of St. Tudwal's, and looked at a little distance just as if they were breeding, but they only come after Mackerel "seel." As they flew up they broke out into their chorus of cries, which I could hear occasionally from the mainland. Their appearance there probably gave rise to the erroneous idea that they bred on St. Tudwal's. There were, of course, many about Pen Cilan, where they breed in numbers. The Great Black-backed Gulls had bred in one old haunt, and when near them one morning the deep "ag-cag-cag" drew attention to a grand old bird circling overhead. Black-headed Gulls were very numerous—both adult and young—in the green marshes chiefly, and in Pwllheli Harbour, though there were some on the shores at various places, where they were very noisy at night. Most of the adults had already lost, or almost lost, the dark hood.

(To be continued.)

AN OBSERVATIONAL DIARY ON THE NUPTIAL HABITS
OF THE BLACKCOCK (*TETRAO TETRIX*) IN
SCANDINAVIA AND ENGLAND.

BY EDMUND SELOUS.

(Part I. SCANDINAVIA.)

(Continued from p. 29.)

April 30th.—*In situ* by 3.30 a.m. The whole air is obscured by heavy mists, and the sky palled in clouds, yet, notwithstanding, quite a hubble-bubble of rookling is going on, as well as “tchu-whai’s,” “choc-kerada’s,” and the “chucking” of hens—also a sharp whisking sound, which has more of a whistling intonation than I have yet heard.

Now, with the lightening, and somewhat earlier than usual, all this ceases, except for an occasional bird or so. This cessation is a very marked feature. On the morning when I unfortunately came late, and found the birds on the ground, this was at about 5 a.m. It would be contrary to my experience, on every other morning, had there not been this pause, and the probability is that the birds had not been long down—or, at any rate, active—when I came. The stillness is now complete. “Roorr-roorr-roorrr,” as a preliminary, and then the rest—that sentence—is the Blackcock’s full rookle or whirlble, and this is repeated over and over again for an indefinite period. At intervals there is a sort of break in the note. “Rerr-rerrker-rer-rer-rer” the bird says, then, in a higher key, and then the other recommences.

I have just heard, for the first time, the soft-sounding, but bellicose, “choc-kerada” note, uttered in a tree. It was by one of two birds, in two birches, not far from each other. One of the pair now flies down, though not into the arena, and the other, still in his tree, utters the note several times; then he flies down too. All the notes, then, may be uttered as well

perched in a tree as on the ground, though, on a short acquaintance with the bird, it would seem otherwise.

No bird has come down upon the courting-place, and as it is, now, as I suppose, past 7 a.m., there is no likelihood of it.

May 2nd.—This morning was quite a blank (yesterday, as it was raining, I did not start). It seems now as though the place, rather than the season, were to blame. The game-laws not being enforced, men from the settlement are out with guns every morning, and this may make the birds shy and wild, and prevent them coming down. The weather, however, is very bad, and may have something to do with it.

May 4th.—At place at the usual time—about 3.30 a.m.—but there was nothing to record till much later. It was a dreadful morning—cold, heavy with clouds, and sometimes raining a little. There being small signs of activity, on the part of any birds, about 6 a.m. I gave it up, and was walking back, when it struck me that appearances were now a little better; more birds seemed coming into the trees round about, with rooklings and “tchu-whai’s” on the increase. I therefore sat down under a fir, on a rising knoll commanding another, though not quite so good a view of the arena, and had not long done so when a cock flew into a small Scotch fir, close to where, had I stayed where I was, I should have been sitting. From here he flew into another tree, and then into one or two more, as I thought from mere restlessness, till I noticed a hen in a tree near, and when she flew to another, he did so too, as had no doubt been the case before, and soon both went down amongst the firs to that side of the arena. After a time, however, they flew up again, perching in contiguous trees, as before, and now the hen began to “tehuk, tehuk” loudly, and kept on doing so for a considerable time. Here, again, we have, not an “indifferent,” or “passive,” spectator of these nuptial performances—a sort of stuffed bird for live ones to dance in a ring about, such as we have been asked to believe in—but an interested participator in them.

All at once, two or three cock birds flew into the arena, and were, before long, followed by others, and a few hens—three or four of the latter to some half dozen of the former. Now there was some real fighting amongst the cocks, confined, however,

almost, if not entirely, to two who seemed to pick each other out, one, in particular, being nearly always the seeker. They fought in the ordinary manner, sparring up against one another, and, I think, seizing hold with the beak; but though, as I say, it was real fighting, it was not remarkably violent, and did not last long at a time. After a bout of it the bird who had sought the encounter by entering his opponent's territory, got back again into his own, and, having paid some attentions to a hen or two, would again come swelling up, and being received, by the other, with a bold front, the duel was continued.

There was, now, a fair amount of courting, on the part of various males, but, owing to the nature of the ground, which, though flat, is uneven, and set with tufts of a wiry, brown heather, I could not follow this nearly so well as I should have liked to; the hens particularly, on account of their smaller size, and brown, heather-like colouring, were often invisible, coming into sight only at intervals, and shortly disappearing again. For these reasons I was only able to get general impressions, and can give no detailed account of this or that episode. It appeared to me that, in the manner before described, the cocks went round the hens in rather a wide circle, and that the *raison d'être* of this was the showing to advantage of the white tail, which, as the male walked forward, after passing the hen from behind, was presented directly to her view. Also, whilst the actual courting was taking place, the cocks, as I thought, though now in close proximity to one another, were less inclined to engage in combat, the martial spirit seeming to be in abeyance, or put aside for the more important matter of the display; but again, lest it should be forgotten, I draw attention to the fact that the martial spirit, all along, has been remarkably tame. For the hens, whenever I could see them, they certainly seemed to know they were being courted, but to what extent they were impressed, and whether the object of the males was in any case achieved—though I do not think so—I was unable, for the reasons above given, to say; I believe, however, that, under such conditions, it is easier than one would imagine to be mistaken on this point.

The scene ended by all the birds flying off, on a sudden, just as they might have done had a gun been fired, but there was no

sound that I could hear, and nothing, I believe, had disturbed them. It was evidence of this, I thought, since a distant shot would not have disturbed them at all, that they did not fly right away, but only into the trees that closely skirted the arena, and also that one or two males returned, again, though there was no further gathering. Thus spontaneously, then, and in so sudden a manner, may the meeting break up.

May 5th.—No birds came down this morning, and not only so, but the rookling round about was much fainter, and I hardly heard another note. A shot before I arrived—for I was only there at 4.30 a.m.—may perhaps have accounted for this; but, looking back, I cannot now recall that the birds uttered their usual cries, yesterday, when in the arena, and, even in the trees, I think they were less than before. It was a wretched morning, and cold, but hardly, if at all, more so than yesterday.

May 6th.—On spot about 4 a.m. The arena was empty, but, shortly after the sun had risen, two birds flew down into it, one closely following the other, and, from the positions which they took up, I judged them to be the two combatants of my last observations, for I made none yesterday. They immediately began making little flights over the ground, with springs into the air, and, getting together in this way, were soon *aux prises*. The fighting, however, was of the most timid and half-hearted description, and, after a few very disappointing bouts, it ceased altogether, and each bird took up its position in a certain part of the ground, corresponding with last time. Here, for upwards of an hour, as I should suppose, each bird rookled, “tchu-whaied,” and made, at intervals, those little springs into the air, out of which it is easy, now, to see that the more developed “dance” has been evolved. These were, this morning, of a more definite character than I have hitherto seen them, and consisted of a leap up, and a little forward, in which the wings were fluttered, and then a drop, plumb down, when, I think, they were closed. As each bird sprang, he uttered a deep and prolonged “chorrerrr,” and, on coming down, made a few steps forward, and sprung again. Now this was what the bird in Norway did, except that he leapt continually, without stop or pause, and uttered, all the while, not one note only but a series of most extraordinary ones, which often sounded like violent

hisses. He seemed to go mad, in fact, and, both in voice and action, gave much more the idea of a rampant cat than a bird. By all appearances he was a very great brave, a mighty warrior of the tribe, but when another bird flew down into the space where he was performing, he retired—nay, ran out of it—in the tamest way possible; so that the sudden transition from the raging thing he had been, to *this*, had something the effect of an optical illusion—the eye was amazed by it.

In fact, with the Blackcock, as with other birds, bellicosity seems to go hand in hand with timidity, and it may be out of these two elements, possibly, that the “war-dance”—so to call it—has arisen. I am theorizing on what I have seen. Had these two birds been as bold as they were hostile, had they felt no nervous sensations, they would have fought, instead of leaping and “chorrning”; but they were afraid, or half afraid, to fight, and these antics were a relief to their feelings. Animals, in their psychology, are like pictures which resemble us in outline, but want the shading. They have our grossnesses, so to speak, but not our refinements. Thus, a bird might be afraid of another bird, but it would not be ashamed of being so, and so would do nothing on the principle of saving its face, or trying to disguise its own feelings from itself. Still the wishing to fight, and not daring to, would certainly produce mental discomfort, for which some relief must be found, and it is not easy to imagine a better one than violent actions, which, prompted by the very same feelings, which, without the check of fear, would issue in battle, might in time become, to some extent, a substitute for this. Thus, amongst ourselves, men who both lack courage, and are of a low, coarse nature—Pistols, not Connachers—find relief for the failing, in boasting and braggadocio, and we may here, in essential elements, see, approximately, the same thing, for in human psychology, too, there is more or less *shading*.

If, then, the dancing of the Blackcock be something distinct from the nuptial display, it need not, for that reason, be either a challenge, or a means of “getting up” courage, nor yet the mere safety-valve of sexual excitement. It may be, rather, (though all these various elements may play a part) a substitute for actual battle. Nothing, to look at it, can be more exhilarating, and, while it has none of the disagreeables of fighting, it cannot

have less influence on the choice of the female bird, if, as I believe, she is not won by fighting, but by courting. In fact, with such a resource as this, blows might, to a large extent, be dispensed with, and, in the one case where I saw the thing in its perfection, they certainly were.

I thought, naturally, with these two birds down, and such a morning as this—for it was fine and sunny—that more would follow, and that I should see something of the sexual relations of the species. However, “I was the more deceived,” for no other bird came down at all. These two continued to act as described, at intervals, and also to rookle, but they got gradually tamer, and did not again approach one another. About 7 a.m. they flew off suddenly, just as had the whole assemblage, two mornings ago, though here, again, I do not think anything had disturbed them. Perhaps, therefore, it may be natural for the meetings to break up in this abrupt manner.

The above was the last observation on the nuptial habits of the Blackcock which I was able to make whilst in Sweden.

(To be continued.)

THE "ASTERISCUS" IN FISHES.

BY COLONEL C. E. SHEPHERD.

INSIDE the skull of Teleostean fishes there are six otoliths, concretions of limestone, nearly pure carbonate of lime, that are contained in the membranes of the auditory labyrinth; they are placed three on each side. One, much larger than the other two, is the *sagitta* of scientists, and is familiarly known as the "earstone" or "earbone," but in the families of the *Siluridæ* (Catfishes) and the *Cyprinidæ* (Carps), however, it is not the largest, as mentioned hereafter. To the otolith that is found in the "*lagena*" of the *sacculus* the name of *asteriscus* has been given. The third stone is known as the *lapillus*. The *lagena* itself, a more or less pronounced prolongation of the *sacculus*, according to the fish to which it belongs, is looked upon as a rudimentary *cochlea*. The *asteriscus* usually shows the same constancy to the characteristics of the family shape as the otolith known as the *sagitta* does. Retzius,* in his monumental work on the 'Auditory Organs of the Vertebrate Animals,' vol. i., gives in the plate relating to the "*Lepidosteus osseus*" an illustration, natural size, of the *asteriscus* in this fish. It is a little circular stone one-sixteenth of an inch in diameter, and fairly circular in shape. In the plate referring to the "*Amia calva*" in the same work an illustration is given, natural size, of its *asteriscus*, a rounded pear-shaped stone, three-eighths of an inch in length by nine-thirty-seconds of an inch at its broadest part. In another work† by the same author, in pl. iv. fig. 11, he gives a drawing of the *asteriscus* of the Pike (*Esox lucius*), and in pl. iv. fig. 28, a drawing of a similar stone taken from a fresh-water Bream (*Abramis brama*). This exhausts, as far as is known, the detailed illustrations of the *asteriscus*. The mere outlines given in all the plates, with the magnified drawings of the ear-membranes in all the other plates of the first work by Retzius, referred to above, whilst interesting as recording their shapes, show nothing more than outline. The plate accompany-

* 'Das Gehörorgan der Wirbelthiere.'

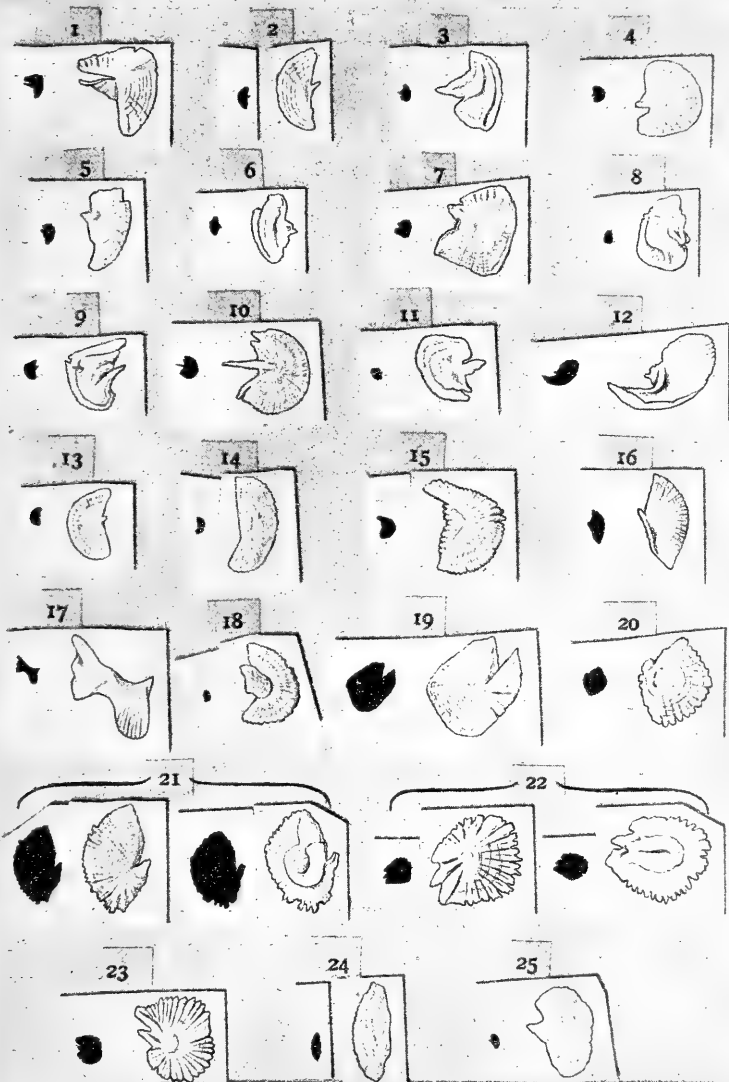
† 'Anatomische untersuchungen, Erste Lieferung.'

ing this paper has been prepared most carefully to give an idea of the varied markings and the indentations on the edges of these stones. The small black illustrations represent the actual size of the *asteriscus* next to it. It will be readily seen that it is only by making a magnified drawing that these various markings and the indentations of the edges can be appreciated. The following tabulated form shows the family and the fish from which the different *asterisci* in the Plate were taken; only some of those fishes having a fair-sized *asteriscus* are given, as many an *asteriscus*, *e. g.*, those of the smaller Blennies and Gobies, is so minute as to be as small, or even smaller, than any full stop in this page of print. Rather more of the *asterisci* of the "*Cyprinidæ*," or Carp family, have been shown than of other families, as their *asterisci* differ from those in other Teleosteans very materially in being the largest of the three otoliths in each side of the skull.*

No.	Family.	Scientific Name.	English Common Name.
1	<i>Percidæ</i>	<i>Serranus gigas</i>	Dusky Perch (Couch).
2	"	<i>Dentex vulgaris</i>	Dentex (Couch).
3	<i>Squamipinnes</i>	<i>Drepane longimanus</i> ..	From Indian Ocean.
4	<i>Mullidæ</i>	<i>Mullus barbatus</i>	Red Mullet.
5	<i>Sparidæ</i>	<i>Cantharus lineatus</i>	Old Wife (Couch).
6	"	<i>Pagellus erythrinus</i>	Erythrinus (Couch).
7	<i>Scorpenidæ</i>	<i>Sebastes norvegicus</i> ..	Bergylt (Couch).
8	"	<i>Scorpena scrofa</i>	From Mediterranean.
9	<i>Sciænidæ</i>	<i>Otolithus maculatus</i> ..	From Indian Ocean.
10	<i>Carangidæ</i>	<i>Caranx trachurus</i>	Horse Mackerel.
11	"	" <i>armatus</i>	From Indian Ocean.
12	"	<i>Lichia amia</i>	From Mediterranean.
13	<i>Scombridæ</i>	<i>Pelamys sarda</i>	Pelamid (Couch).
14	<i>Cottidæ</i>	<i>Trigla cuculus</i>	Elleck (Couch), a Gurnard.
15	<i>Mugilidæ</i>	<i>Mugil capito</i>	Grey Mullet.
16	<i>Gadidæ</i>	<i>Merluccius vulgaris</i> ..	Hake.
17	"	<i>Gadus luscus</i>	Whiting Pout.
18	<i>Pleuronectidæ</i>	<i>Solea vulgaris</i>	Sole.
19	<i>Siluridæ</i>	<i>Arius gagora</i>	From Indian Ocean.
20	<i>Cyprinidæ</i>	<i>Tinca tinca</i>	Tench.
21	"	<i>Cyprinus carpio</i>	Carp.
22	"	<i>Abramis brama</i>	Fresh-water Bream.
23	"	<i>Leuciscus rutilus</i>	Roach.
24	<i>Esocidæ</i>	<i>Esox lucius</i>	Pike.
25	<i>Clupeidæ</i>	<i>Chanos salmoneus</i>	From India.

* It is well perhaps here to note that in the *Siluridæ* the *lapillus*, the otolith of the *Recessus utriculi*, is the largest otolith.

ASTERISCI.



A.H. Searle, del.

With the exceptions noted as from the Indian Ocean or the Mediterranean, all the other fishes of the list are to be found in British waters.

There are sixteen families represented. As a rule the *sagittæ* in a fish are homogeneous in texture;* it is more often not so with the *asterisci*, and this may when they are large enough be noticed with the naked eye. In most of those mentioned above and shown in the plate there is a chalky-looking kind of deposit in the centre of them; it is most particularly observable in No. 20 (the Tench) and No. 21 (the Carp), owing to the larger size of these *asterisci*. No. 22 (the fresh-water Bream), however, also one of the *Cyprinidæ*, has homogeneous *asterisci*. The normal appearance of an *asteriscus* is of a vitreous description; this is particularly observable in No. 16 (the Hake), which looks like a delicate piece of Venetian glass. Fifteen out of the twenty-five figured show traces, generally very marked, of this chalky-looking matter in their structure, this being in the centre of the *asterisci*, whilst the edges keep their vitreous character. This chalky appearance is possibly due to an excess of organic matter, and is not constant; sometimes the *asteriscus* of one side shows it strongly, whilst the other side keeps its vitreous character; in other cases both stones are affected, but in different degrees. The position of the *asteriscus* in the head, beyond being in the *lagna*, is difficult to determine on account of their small size, but if the plate is turned upside down the *asterisci* of No. 21 (*Cyprinus carpio*) will assume the position in which they are in the skull. The then left-hand one showing the inner aspect of this otolith, and the other the outer aspect.

Why the *asteriscus* in the Carp family (the *Cyprinidæ*) should have developed so largely and the *sagitta* dropped into a small rod-like stone is hard to explain. The Pike (*Esox lucius*) and the Perch (*Perca fluviatilis*) have the usually developed *sagittæ*, so it cannot be simply that the Carps live in fresh

* After dissecting for otoliths the skulls of some three hundred different species of fish, with of course often many of the same kind in each family, only three cases of abnormal *sagittæ* have been come across, and these in eighty species of fish from northern waters. The other two hundred and twenty species from the Indian Seas off Madras and the Mediterranean did not produce a single abnormal *sagitta*.

water, for those two fishes do the same. The Carp family have their auditory organs in connection with their air-bladders, but so have several of the *Clupeidæ*, e. g., the Herring (*Clupea harengus*) and the Pilchard (*Clupea pilchardus*);* these have the *sagitta* as the largest otolith. Certain also of the *Serranidæ* (Perch family), *Sparidæ* (Sea-Bream family), and *Gadidæ* (Cod family)* have a connection between the air-bladder and the auditory organs; all these families have the *sagitta* as the biggest otolith. True, they have the connection between the air-bladder and the auditory organs arranged on a different plan to that adopted in the anatomy of the Carps, but are mentioned to show that it is not due simply to the fact of their air-bladder and auditory system being connected that makes the arrangement necessary to increase the size of the *asteriscus*. Again, the *Siluridæ*, which have the same method of connecting the air-bladder with the auditory organs, as in the *Cyprinidæ*, viz. by a series of movably connected ossicles, have the "*lapillus*" as their largest otolith (see note *ante*); their *asteriscus*, though well developed, is relatively small compared to that in the Carp family. A point of resemblance in these two families is that each has a rod-like *sagitta*.

The *asteriscus* of the more strictly *Gadus* branch of the *Gadidæ* (the Cod family) differs materially in shape from that in other Teleostean fishes, as exemplified by No. 17 (the Whiting-pout); the same stone, No. 16 (the Hake), classed with the *Gadidæ*, is much the same as the other fish examples shown, its resemblance to Venetian glass having already been noted.†

One characteristic of the shape of the *asterisci* that seems to be common to a great many families is the little spike that projects from the middle of one side; it is apparent in sixteen out of the twenty-five figured. It is so delicate as to be very easily broken when dissecting this stone out of the ear-membranes.

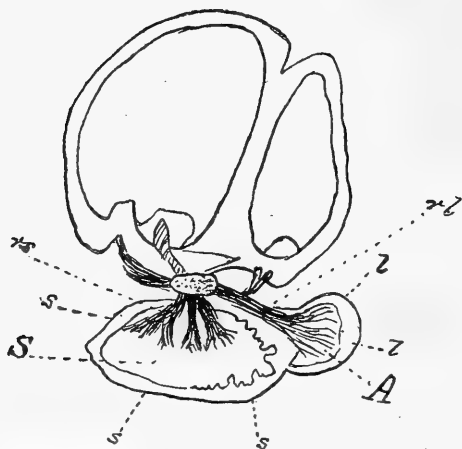
Upon what are the actual uses of the otoliths in the working life of Teleostean fishes authorities are not agreed. The older

* *Vide* 'The Cambridge Natural History,' vol. vii. p. 389, quoting Bridge, Ridewood, E. H. Weber, and Bridge and Haddon.

† The *sagitta* in the Hake, a long thin stone, is also markedly different to that of the true *Gadidæ*, which have a solid thick stone.

men of science saw in them only a means of increasing the sound vibrations, and so making the hearing of the fish more acute. Some modern authorities seem to see in them only an organ to enable the fish to retain its equilibrium in the water, and point to cases where, when the otoliths have been removed, together with the semicircular canals, the fish has not been able to remain in its usual vertical position. Others, and possibly more correctly, credit the otoliths with the dual functions of helping the equilibrium, as well as assisting the hearing. Why three on each side of the head are needed no one has

PAGELLUS CENTRODONTUS.



[After Retzius.

A. asteriscus ; *S. sagitta* ; *l. lagena* ; *s. sacculus* ;
rl. Ramulus lagenæ ; *rs. Ramulus sacculi*.

attempted to explain. But whatever their office is, it is clearly very important when one sees the number of nerve filaments spread over the *sacculus*, and also that end of it called the *lagena*, showing that the *asteriscus* carries on its full share of the work done by the otoliths. The accompanying drawing, reduced from the first-mentioned work of Gustaf Retzius, depicting the auditory organs of a "*Pagellus centrodontus*"

(a sea-water Bream), shows the situation of the nerves. It may be taken as fairly typical: It shows the *asteriscus* and nerve, the *Ramulus lagenæ*, or the Branch of the *lagena*, spread root-like over the outer surface of the *lagena*, just over the place where the *asteriscus* is situated.

In concluding this article, the assistance received, given by the courtesy and liberality of the administration of the 'Stazione Zoologica,' Naples, must be recorded; without it many of the specimens here shown could not have been brought to the notice of the reader.

SOME FISH-NOTES FROM GREAT YARMOUTH FOR 1909.

BY ARTHUR H. PATTERSON.

AN error inadvertently made by me in "Notes for 1908" (Zool. pp. 445, 449) it would be well to correct. Crucian Carp, referred to as occurring numerously at Lound, should have been Prussian Carp (*Carassius gibelio*). During the summer of 1909 I was fortunate in obtaining examples of *C. vulgaris* (the Crucian Carp), the Mirror Carp (*Cyprinus specularis*), and a hybrid, identified by the British Museum authorities as between the Common and Crucian Carps. Several of the latter have lived for some time in amity with some *gibelio* in one of my tanks.

The past year has brought to notice several deformities among Cods, the "bull-dog" variety, with shortened upper lip, in particular; and on January 5th I examined an example with a badly distorted under jaw, the result of an accident; the barb or labial cartilage was growing on the right side instead of depending amidships below.

A few boats put out after Shrimps as early as the first week in January. Several very good catches of "Pinks" (*Pandalus annulicornis*) were brought in on the 8th, many of them being large in berry. I found them also in spawn in February.

January 23rd: Sprats still being taken. I had some for tea, individuals containing roe and milt.

From the 'Angler's News' annual list of large fishes taken by sea-anglers I culled the following for Yarmouth:-- November (1908), Dab (*Pleuronectes limanda*), 1 lb. 8 oz.; October 16th (1909), Flounder (*Pleuronectes flesus*), 3 lb. 15½ oz.

A Jago's Goldsinny (*Ctenolabrus rupestris*), of a beautiful pink colour, 3¾ in. in length, brought me by a shrimper's boy on April 26th. It smelt very much like celery. A Ballan Wrasse (*Labrus maculatus*), of the green variety, 9 in. in length, was taken in a draw-net the following day.

American Rose Perch (*Scorpena dactyloptera*): a six-inch example sent me from Lowestoft on May 13th.

On May 19th, for the first time, I fell in with the Burton Skate (*Raia alba*), the young of which, as depicted by Couch under the name of the Bordered Ray, is distinguished by a well-defined wide border of black upon the white under side of the fish. My fish, which was $11\frac{1}{2}$ in. long and 8 in. across the disc, I despatched to the late Mr. T. Southwell, who had no hesitation in referring it to the above species. The upper side was drab-coloured, with no spiny process anywhere but on the tail, which contained three rows of spines, and there were one or two against each eye. This was the last fish, of a goodly number, which my dear departed friend was delighted to receive from my hands.

Blue Mackerel: I received my first whole-coloured Blue-backed Mackerel (*Scomber concolor*), a fifteen-inch specimen, on May 25th. A second came to hand on June 1st, 14 in. long, and a third two weeks later on.

On June 1st I examined some fine Plaice from the White Sea. I noticed that the spots were a bright orange set in a faint white ring. One fish in particular, which had a dark under side, and the corresponding spots (for when a Plaice is coloured below it is also spotted, wherever the colouring may extend to) had them also set in a ring of white.

A very beautifully marked Brill brought me on June 29th from Lowestoft (*vide* Zool. 1909). The groundwork of the upper surface was white, with spots and blotches of the normal colour prettily arranged.

I observed some "Dogs" on a fish-slab in a back street on July 12th. One, a large Tope (*Galeus vulgaris*), was destined for the frying-pan; another, also fated to share the same honours, was a Picked Dog (*Acanthias vulgaris*), 3 ft. 3 in. long, weighing 9 lb., a very large example for this coast.

Salmon: a $14\frac{3}{4}$ lb. Salmon was netted on Breydon during the second week in August.

A lady angler, fishing from Claremont Pier, Lowestoft, had an exciting time on August 4th with a Sting Ray (*Trygon pastinaca*), which she successfully landed, to the great interest of less fortunate anglers; it weighed 35 lb.

Herring-fry was remarkably scarce on local waters during the month of August. Breydon usually teems with the silvery little "syle," to the great delight of the Terns, which flock thither under normal conditions to feast upon it, and of the Gulls that gorge themselves with those left stranded among the *Zostera* when the tide falls off the flats. The Terns were conspicuously absent during all the autumn.

During a stroll along Gorleston beach on August 26th I saw a great number of Lesser Weevers (*Trachinus vipera*) washing about with Little Squids (*Loligo rondeletti*) and tiny Pollacks, &c., the refuse from the draw-nets and shrimp-nets. Some visitors' children were playing "shops" with a number spread out upon a box; some of these were among the finest specimens I ever saw. How those children escaped injury from the fishes' poisonous dorsal spines was to me more than marvellous. Young Pollacks a few inches long came up river numerously from the sea in September.

In the middle of September a curious inshoring of Herrings was noticed at Lowestoft, the fish coming quite into the breakers, and many were flung up in the wash of the sea. Young urchins, armed with baskets, fetched them out, to their own great delight.

A Smooth-hound (*Mustelus vulgaris*), about 15 in. in length, cast up on the south beach, September 30th.

On the evening of the same date I was visited by two fellows from a neighbouring public-house, who begged me to return with them to see a curious fish which no one could name. I accompanied them thither, to find the bar crowded with rough fellows in various stages of intoxication and excitement, while bets were being freely made upon the creature, and upon my decision. A space being cleared by "Toby" Blake, a local Eel-netter, and to whom the fish belonged, it was shot out of a large rush basket on to the sawdust-covered floor. It was a vile-looking object, almost black in colour, the eyes covered with a white film, and the whole being flabby and offensive to the touch and smell.

"Now then, 'bor, *what* is it?" asked several husky voices. I examined it as well as the haze of pungent tobacco smoke and the gloom of many shadows would allow me, and pronounced it

a huge Broad-nosed Eel. "That's what I say," remarked "Toby" Blake, in a husky voice. Others protested it was a Conger, but the position of the dorsal fin and its general appearance were against the latter. Blake informed me it weighed 24 lb., and I myself measured it at five feet in length, with a circumference equal to an average man's thigh. Rumours were rife that it was taken in the neighbourhood, but I afterwards learnt it had come from some northern river, and sent by Blake's son, who was fishing out of a Yorkshire port. The largest Eel record for Yarmouth was described by a local historian as taken in the Yare, a mile below Yarmouth Bridge; he called it a "Silver Eel." Length, 6 ft. 1 in.; 21 in. in girth; weight, 42 lb.

Being informed, on October 18th, that near the harbour-mouth I should find a stranded sea-monster, I accordingly rambled thither, to find the putrid remains of a Porbeagle Shark (*Lamna cornubica*), which had probably been taken in a Herring-net and cast adrift.

An inshoring of Whitings was noted early in October, great numbers being taken by sea-anglers from the piers; whilst at Lowestoft they were caught in thousands.

Early in the month of October two large Cods were observed tumbling about in the breakers, within a few days of each other; they were fished out with walking-sticks. One weighed 24 lb., the other 27 lb.

Several Five-bearded Rocklings (*Motella mustela*) were taken in October and November.

A Flounder coloured on both sides, and with one eye on the "edge," was sent me from Lowestoft on October 28th. It was 10 in. in length.

During the week ending October 29th there had been some catches of fine Soles on the local piers. A visitor fishing from the Britannia Pier caught in the morning one weighing 1 lb., in the afternoon one weighing $1\frac{1}{2}$ lb., and in the evening a still larger one scaling $1\frac{3}{4}$ lb. This was on October 21st.

Great numbers of Scads (*Trachurus trachurus*) captured in the Herring-nets at end of October.

Pollack: another inshoring of this species, averaging $7\frac{1}{2}$ in., all along the coast. Early in November.

I saw some very fine Smelts (*Osmerus eperlanus*), taken on

Breydon, November 3rd. Several were quite as large as full-grown Herrings.

A very curious incident occurred in Yarmouth Roads, when a Middlesborough steamer encountered strong winds and heavy seas. When abreast of the town a particularly heavy sea was shipped, and when the water had receded the deck was found to be half-covered with Mackerel, a species which was exceedingly abundant on several occasions during the Herring fishing. Many of the Mackerel were washed back into the sea through the scuppers, but enough were secured to serve the crew with fresh fish for two or three days.

On November 25th Mr. Robert Beazor exhibited on his fish-slab a very pretty little Sunfish (*Orthogoriscus mola*), which had been taken in a drift-net and landed on the fish-wharf. It measured $25\frac{1}{2}$ in. in length, and from tip of dorsal to tip of anal fin, 36 in.; weight, $26\frac{3}{4}$ lb.

A Sprat famine characterised the East Suffolk fisheries during the end of 1909.

I have to thank Mr. Robert Beazor for the following notes on the local Smelt fishery of 1909. He writes:—"The Smelt season commenced in the beginning of March, the Gorleston fishermen starting, when some six or eight boats landed catches varying from three to eight score. They were exceptionally fine fish. Many of the river smelters had given up and sold their nets and boats because of the action of the Bure and Yare Commissioners, who debarred them from fishing above Breydon [a very senseless procedure, as no fresh-water fishes come down so low as the confluence of the two rivers, nor for miles above it, owing to the constancy of salt water, which goes higher up rivers year by year]. This caused a certain supply of Smelts to diminish. April was a fair month, and when the weather allowed the beach boats to work some procured from thirty to forty score a day. The largest Smelt I weighed was 22 oz., and I have had as many as fifty Smelts in on one day weighing 16 oz. apiece. The autumn fishing was a failure; what few were taken were secured at the top end of Breydon. I sent away sometimes as many as four thousand fish per diem—a much lower figure than in some years. Prices were remunerative to the catchers, who averaged two shillings per score, the highest

price being three shillings and sixpence ; they were occasionally as low as one shilling per score. The large import of Dutch Smelts into London greatly influenced the English supplies, although the latter always command the higher prices. Very few Grey Mullet or Salmon-Trout were netted with the Smelts, owing undoubtedly to the wretched summer. Drawing for Trout along the coast was also a failure. My largest lot at any one time this year was 80 lb. My largest Trout was $10\frac{1}{4}$ lb., an example $16\frac{1}{2}$ lb. being my record fish. Very few Salmon-Trout and Red Mullet were taken in the Mackerel-nets this year ; last year I purchased Red Mullet by the trunkful ! Numbers of what we call ' Red Trout ' [Bull Trout ?], running from 6 oz. to 10 oz. each, were captured. Fishermen aver that when these are about ' you may whistle for fine Trout.' Those landed fetched good prices."

Amongst the Crustaceans my most interesting " finds " were two aged *Æsop's* Prawns (*Pandalus annulicornis*) with barnacles growing on the carapace, and a *Crangon vulgaris*, the posterior half of which was ivory-white.

NOTES FROM MILLPORT MARINE BIOLOGICAL STATION.

BY RICHARD ELMHIRST, F.L.S.

COMMON HERMIT-CRAB, *Eupagurus bernhardus* (L), ASSOCIATED WITH *Suberites domuncula*.

THE Hermit-Crab, which is usually found associated with the Sponge (*Suberites domuncula*), is *E. pubescens* (Kroyer), just as *E. prideauxi* is always found associated with the Cloaklet Anemone (*Adamsia palliata*).

Out of several thousand Common Hermit-Crabs which I have taken at one time or another there have been three associated with the above Sponge. In June last year I took a very small *Adamsia*, about 3 mm. wide, of course with an immature *E. prideauxi* inside. They are locally called "Strawberry Crabs." Fish do not seem to touch them for food, probably on account of the stinging powers of the *Adamsia*. The Common Hermit is, of course, a favourite item in the food of the Cod, Thornback, and other fishes.

MOULTING AND REGENERATION OF *Galathea strigosa*, Fabr.

In February, 1908, I took two adult specimens of this beautifully blue-banded Squat Lobster at low tide. One is fairly certain to find them during spring ebbs either on the "Eilans" in Millport Bay or about the Pier.

I first noticed the larger one (A) to be carrying spawn ("in berry" or "with coral") on May 5th; hatching began on the 16th, and of course lasted several days. On July 21st, 1908, she moulted, again in January, 1909, and again on the following July 21st. A few weeks later this specimen died.

The smaller one (B) spawned soon after A, moulted on July 31st, 1908, again January, 1909, again on July 12th, and lastly in December, but died a few days later.

In April, 1909, considerably after the second moult in captivity, A cast off her right cheliped when I was holding her in my

hand. At the next moult in July a new limb appeared about half the size of the old one, its growth having, of course, been indicated by a papilla about 1 cm. long projecting from the stump. On July 14th, two days after this new limb appeared, I induced her to throw it off by handling. At the following moult in December another and finer limb had appeared.

The following table gives the sizes of the chelipeds, chelæ, and carapace :—

		Length of Cheliped	Breadth of Hand	Length of Hand	<i>Carapace, length measured from the tip of the rostrum.</i>	
After Jan. moult 1909	old limb	6 cm.	1 cm.	2·8 cm.		
	old limb	6·2 „	1 „	2·9 „		
At July moult	new limb	4·2 „	·6 „	1·9 „	After Jan. 1909 moult	2·7 3·6
	old limb	6·4 „	1·1 „	3·1 „	After Dec. moult	2·85 4·0
At Dec. moult	new limb	4·6 „	·7 „	2·1 „		

G. strigosa lives well in the aquarium, but is of a very retiring disposition, and always tries to hide in the darkest corners of the tank. They keep themselves wonderfully clean, and do not become overgrown with small algæ. When disturbed they swim rapidly, generally on their backs; if they happen to be at the surface they make a great flapping, and show well the action by which they have earned the name of "Flappers" from the fishermen.

ON THE LOBSTER.

Lithodes maia, the Stone-Crab, becomes overgrown with small algæ, &c., in the aquarium, as also does the Lobster. The latter, however, cleans them off where he can reach them, as, for instance, round the eyes. Sometimes also considerable plants of *Laminaria* (oarweed) grow on the Lobster and Stone-Crab. The former generally keeps them trimmed, especially on its antennæ. This natural appearance of weeds on animals in the tanks, which at times must become traps for the spores of algæ, &c., brought in by the circulation, is quite a different thing from the dressing of themselves which has been noted in such Crabs as *Hyas*. A Lobster lately lost an antenna. After

the wound had healed the usual papilla appeared and grew in a coil, until there were about three turns in it. It, of course, showed indications of the future segments. At the next moult an antenna appeared, about two-thirds of the length of the old one, but with a curl of half a circle at the end of it.

Lobsters sometimes get an idea of working, and for several days will clear a path right round the sides of their tank, heaping up the pebbles on the bottom in the middle of the tanks. They have done this several times. One morning a Lobster which had cast his skin overnight solemnly set to work to bury his old skin among the pebbles. Newly moulted Lobsters seem to be regarded as delicacies by Congers.

“PULL” OF *Solen siliqua*.

When disturbed in its natural surroundings the Spout-fish is capable of quickly and strongly withdrawing into its hole in the sand. This is probably done as follows: Some Spout-fish I had in a dish of sea-water overnight had stretched out their feet and siphons. When I disturbed them some just contracted, but three others, which were very well extended, expanded the ends of their feet to about two inches in diameter, and withdrew suddenly. This is surely how they get such a grip of the sand. The inflated end of the foot with upturned edges was like a Mushroom-anchor; even a soft, fleshy Mushroom-anchor pressing into the sand would give an enormous hold. The foot of the Spout-fish is locally called the “pull” (“u” pronounced as in dull).

SPAWN OF *Oscanius* (*Pleurobranchus*) *membranaceus*.

When trawling on Ascog Bank, near Rothesay, several large masses of spawn came up. Each of these masses consisted of a soft gelatinous ribbon, about one inch thick and several feet long, in an irregular coil. A spiral thread, containing the egg-capsules, runs through the ribbon. There seems to be one egg in each capsule; the diameter of an egg is about .1 mm., and that of a capsule .16 mm. Several *Oscanius* came up in the same haul, and I suspected this was their spawn. I isolated some of them, and on August 29th, after three days in captivity, one of them deposited a coil of this spawn.

THE WOLF IN SCOTLAND AND ELSEWHERE.

BY J. R. McClymont.

A FEW lines in the panegyrical poem "Forth Feasting," by Drummond of Hawthornden, which was published in 1617 on the occasion of the visit of King James I. to Edinburgh, reveal certain interesting points of difference between field sports in the seventeenth century and at the present day. The lines run thus:—

"When years thee vigour gave, O then how clear
Did smother'd sparkles in bright flames appear!
Amongst the woods to force a flying hart,
To pierce the mountain wolf with feather'd dart,
See falcons climb the clouds, the fox ensnare,
Outrun the wind—outrunning dædal hare,
To loose a trampling steed alongst a plain
And in meand'ring gyres him bring again,
The press thee making place, were vulgar things."

The mental picture suggested by the flying hart forced into a wood by the tactics of its pursuers reminds us that the Normans hunted deer on horseback and on foot, employed dogs in the chase of them, and shot them with arrows; and it is to this mode of hunting Red Deer that Drummond alludes. It would be to the advantage of those who engaged in the hunt to drive the hart into a wood where its speed would be checked, and where it could be shot by hunters in ambush. The climbing of clouds by Falcons is an allusion to falconry, which survives from olden times without important change, and the outrunning of the Hare, dædal or fertile in resources, must have been akin to coursing.

Drummond names two other forms of outdoor diversion which are without counterpart in our days—at least within the British Isles—namely, setting snares for Foxes and piercing Wolves with feathered darts—"feather'd dart" being doubtless a periphrasis signifying "arrow." The employment of the epithet "mountain" might induce us to believe that a Wolf

inhabiting mountainous districts existed which differed in some respect from that which inhabited the Lowlands. There is, however, no evidence to support such an hypothesis, and we must therefore suppose that the epithet is employed by Drummond merely as a poetical embellishment. It is worthy of note that there is a melanistic form of the European Wolf, which is said to be most common in the Pyrenees, and which may have existed in Scotland when Drummond wrote.

An oral tradition, which assigns no date to the occurrence, and which is probably of little value, indicates the vicinity of Bridge of Allan as the locality in which a Wolf was last killed in Scotland. In Roxburghshire are several local names which indicate the presence of Wolves in that county. There is, for example, near the confluence of the Teviot and the Rule, the farm of Spittal-on-Rule, which very probably derives its name from having been one of those "spittals" or places of refuge which were provided for the benefit of travellers in danger from Wolves.

Boccaccio has a description of the mode in which Wolves attack a Horse. The incident which he describes is supposed to take place in a forest between Rome and Alagna; so an English version prints the name, but doubtless Anagni, about twelve miles north-west from Frosinone and about forty-five miles from Rome, is the town which is meant. The hero of the tale, Pietro Boccamazza by name, being overtaken by night in the forest, tethers his Horse to an oak, which he climbs for safety. Presently a pack of Wolves appears. The story proceeds thus: "Now, as for Pietro, he had but a dismal night of it, for he saw his Horse soon surrounded by a number of Wolves, which made him break his bridle, and he endeavoured to make his escape, but was so encompassed that he could not, and he defended himself with kicking and biting for some time, till at last he was pulled down and torn all to pieces, and, having devoured him to the very bones, they went away."

In conclusion, it may be remarked that if, as is alleged, James I. introduced a foreign variety of the Roedeer into Great Britain (thereby adding one more reason why Wolves should be exterminated), he cannot have been quite as indifferent to the interest of the chase as Drummond supposed him to be.

Hobart, Tasmania.

Zool. 4th ser. vol. XIV., February, 1910.

NOTES AND QUERIES.

MAMMALIA.

Bechstein's Bat (*Myotis bechsteini*): a Correction.—The Rev. J. E. Kelsall (*ante*, p. 30) has made one example of Bechstein's Bat into two. The mistake doubtless arose from Mr. Millais's original record of the specimen (P.Z.S. 1901, ii. 216) as captured "in the neighbourhood of Henley-on-Thames," which is, as everyone knows, in Oxfordshire—that is, on the north bank of the river; but Mr. Noble's caves in the chalk are on the south bank, which is Berkshire, in Remenham parish.—A. H. COCKS (Poynetts, Skirmett, near Henley-on-Thames, but in Bucks).

AVES.

Reappearance of the Bearded Tit (*Panurus biarmicus*) in an Old Haunt.—On January 29th I was pleased to hear from my brother, Mr. A. M. Rope, that he had lately seen this bird at a spot where, up to about forty years ago, it was often to be found. He was first attracted by its note, and only got a distinct view of two birds, but thought there were probably more; for it is a well-known habit of this species to be constantly flitting from place to place in small flocks or family parties, after the manner of the Long-tailed Tit. For obvious reasons I refrain from mentioning the exact locality, which is, however, not far from the Suffolk coast. Drainage has greatly reduced the area of its former haunts at the place referred to, and grazing marshes now occupy the site of large beds of reeds. The last note I have on this beautiful little bird at this old home of the species is as follows:—"Nov. 13th, 1873. Walked round the 'reedland,' and saw three flocks of Bearded Tits, each containing about eight or nine individuals." From the year 1871 to the date of the above note we often used to fall in with them, and hear their musical tinkling note as they came trooping along, only just skimming the tops of the reeds.—G. T. ROPE (Blaxhall, Suffolk).

Glossy Ibis (*Plegadis falcinellus*) at Yarmouth.—On December 2nd, 1909, near the River Bure, about two miles north-west of Great Yarmouth, a strange bird was seen by a waterman. On reaching home he informed a "gunner" friend, who proceeded to the spot immediately. Meanwhile the bird had retired to the marshes, where it was found standing in a pool of water, where the gunner shot it.

He showed it to the waterman, who identified it as an Ibis, or Black Curlew. It is now in my possession. "Black Curlew" is the name given to the bird by the Breydon gunners, owing to the resemblance of the bills in these birds.—B. DYE (Great Yarmouth).

Slavonian Grebe in Shropshire and Worcestershire.—On the 11th December last my brother and I observed a Slavonian Grebe (*Podiceps auritus*) on the River Severn, in the parish of Dowles, some four hundred yards above Bewdley Bridge. When first noticed it was swimming about in some quiet water near the river-bank; it was very tame, allowing us to approach within about fifteen yards and watch its movements for several minutes. It occasionally dived whilst we were near, in some instances coming up again even closer than before, and it remained above water at longer intervals. Eventually it got caught in the swift current then running, whence it was quickly carried down stream and across to the Worcestershire bank of the river.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

Ornithological Report from Chester.—Permit me to record the following:—

Two immature Peregrine Falcons (*Falco peregrinus*).—Bala, April 19th, 1909.

Osprey (*Pandion haliaëtus*).—Adult female, Capenhurst, May 7th, 1909. The stomach of this infrequent visitor was quite empty.

Great Northern Diver (*Colymbus glacialis*).—Shot December 21st, 1891, during extensive floods, Helsby Marsh.

Immature Black-throated Diver (*C. arcticus*).—Shot January 18th, 1910, River Dee, at Corwen. The gullet of this bird contained seven Common Trout of different ages; the stomach was apparently filled with bones of the same, together with some small pebbles.—A. NEWSTEAD (Grosvenor Museum, Chester).

Ornithological Observations in North-east Surrey, 1909.—The most interesting notes for the year, for this portion of Surrey, are the occurrence of the Golden Plover on Wimbledon Common, whence it had not previously been recorded, and the Common Tern, White Wagtail, and Lesser Black-backed Gulls observed on autumn migrations at Barn Elm Reservoir. At least one hundred and forty-three species have already been recorded from this corner of Surrey; of these, one hundred and fifteen have been seen within the last ten years; this shows the district to be one of the richest, ornithologically, in the county. The Barn Elm Reservoir is comparatively new ground for the observation of bird-life. The only former records from this spot being as follows:—

GREY PHALAROPE.—One reported to have been shot here in October, 1870 (The 'Field').

KITTIWAKE GULL.—Observed a few years ago by Mr. Felton; while Mr. Cornish mentions having seen Tufted Ducks and two Great Crested Grebes here in February, 1902.

WHEATEAR.—One on Wimbledon Common, Sept. 14th; rarely noticed in the district when on autumn migration.

WHINCHAT.—A fairly common summer visitor, usually arriving about April 15th; nests frequently on Wimbledon Common and in Richmond Park.

REDSTART.—Fairly common in Richmond Park during the spring and summer, nesting in the old thorns, &c.; occurs, but does not appear to nest, on Wimbledon Common.

CHIFFCHAFF.—This little Warbler occurs in all parts during the summer, but is nowhere numerous. First heard its welcome note this year on April 8th, Wimbledon Common; also heard it as late as October 6th last, near Raynes Park.

WILLOW-WARBLER.—The most numerous Warbler, usually arrives during the first week in April; nests even on Barnes Common amongst the bracken.

COLE TIT.—Fairly common, especially in Richmond Park, where it nests freely in the plantations.

WHITE WAGTAIL.—Noted one at Barn Elm Reservoir on Oct. 24th; it is probably a regular spring and autumn migrant there.

YELLOW WAGTAIL.—A common summer visitor to district, usually to be seen during the second week in April by the Pen Ponds; nests freely in the reservoir grounds at Barnes.

SWALLOW.—First seen on April 7th about Pen Ponds, while in the autumn they lingered on the reservoirs till Oct. 24th, in spite of occasional cold winds.

SAND-MARTIN.—A regular visitor during spring and autumn; may be seen on the Pen Ponds by the second week in April, while they are very numerous during October on the reservoirs.

TREE-CREEPER.—Fairly common resident in Richmond Park, only occasionally straying on to Putney Heath and Wimbledon Common.

REED-BUNTING.—A regular visitor, though not common, to Richmond Park and Wimbledon Common in the spring. Occasionally seen in the park and in reservoir grounds during the winter, it is known at the latter place as the "Blackcap."

KINGFISHER.—More often seen during the winter; one on Pen Ponds Dec. 2nd; also a pair on reservoirs during November and December.

POCHARD.—A flock of eight arrived on reservoirs Nov. 11th; they had increased to over one hundred by the 21st of the month. They are very shy, and usually keep well out towards the centre.

COOT.—Generally a few are to be seen on Pen Ponds, while they regularly visit the reservoirs in small numbers for the winter.

GOLDEN PLOVER. — One was picked up injured on Wimbledon Common during severe weather in mid-March; it died a day later, and found its way into a local collection.

COMMON TERN.—Observed one flying about the reservoirs on Oct. 10th. The well-known "Sea-Swallow" is probably a regular visitor on migration.

BLACK-HEADED GULL.—A very numerous winter visitor to the Thames; it may be seen often on Wimbledon and Barnes Commons and in Richmond Park. They fly in thousands over Chelsea and Fulham from the London Parks and river adjacent to the city, to their roosting-grounds at Barn Elms. I have often seen some of the reservoirs covered with sleeping Gulls.

LESSER BLACK-BACKED GULL.—A dozen frequented the reservoirs throughout October, remaining there all day, whereas the commoner Gulls spend most of their time up in London.

GREAT CRESTED GREBE.—Fairly common on reservoirs during the winter months, eight being there on Oct. 2nd, ten on Oct. 15th, fifteen on Oct. 24th, eighteen on Nov. 21st, and twenty-five, the largest number I have seen together, by the end of December.

Mr. Mouritz, in Zool. 1907, p. 95, remarks upon the erratic way in which *P. cristatus* appeared upon the Pen Ponds during the early part of the year. This is undoubtedly accounted for by the presence of this species during the winter months on the reservoirs at Barn Elms.—WILLIAM A. TODD (62, Festing Road, Putney, S.W.).

OBITUARY.

EDWARD SAUNDERS, F.R.S.

WE regret to announce the death of Mr. EDWARD SAUNDERS, which took place at Bognor on February 6th. He had been out of health for some time, and had gone to Bognor with the hope that a change would restore him. He was born at East Hill, Wandsworth, on March 22nd, 1848, and was a son of William Wilson Saunders, the well-known naturalist, from whom he inherited his love for entomology. From 1865 to the time of his death he was in the City at "Lloyd's." For many years he devoted himself to the study of

Buprestidæ, of which he published an excellent synonymic catalogue in 1871. He also published in 1873 a 'Catalogue of the Species contained in the genus *Bupestris* of Linnæus. He contributed numerous papers relating to this Family in the 'Transactions' of the Entomological Society (1867-1872), in the 'Journal' of the Linnean Society (1870-1873), and in 'Insecta Saundersiana' (1869). He formed a fine collection of these insects, which became the property of the British Museum in 1874; it consisted of 7267 specimens, of which 364 were types. He also formed collections of British Coleoptera, Hemiptera, and Hymenoptera, and extended his studies of the two latter Orders to the whole of Europe, including the Mediterranean fauna. He contributed numerous notes and descriptive papers to the 'Entomologist's Monthly Magazine' on Hemiptera from 1869, and on Hymenoptera from 1880. Some of the more important relate to the species collected by the Rev. A. E. Eaton in Algeria, many of which were new to science. He published a 'Catalogue of British Hemiptera' in 1876. His most important separate works are 'The Hemiptera Heteroptera of the British Islands,' illustrated by thirty-two plates, in 1892. This was followed in 1896 by a similar work, 'The Hymenoptera Aculeata of the British Islands,' a standard work, illustrated by fifty coloured plates. He was one of the Editors of the 'Entomologist's Monthly Magazine' from 1880, and was a Fellow of the Entomological Society from 1865, the Linnean Society from 1869, and in 1902 was elected a Fellow of the Royal Society.

He married in 1872, and leaves a widow and a large family, one son being a clergyman; others have entered different professions, and one represents him at "Lloyd's."

Edward Saunders was a good man, whom it was both a pleasure and a profit to know, quiet and retiring in his manners, always ready to look at the best side of things, and willing at all times to assist his entomological friends, by whom he will be greatly missed.

C. O. W.

NOTICES OF NEW BOOKS.

A History of the Birds of Kent. By NORMAN F. TICEHURST, M.A., &c. Witherby & Co.

THERE can be little doubt but that in this book we have the standard history of the birds of Kent, and that it will receive general acceptance as of that authority. It represents the work

of sixteen years, it is written by one who is thoroughly master of his subject, and he has been assisted by the information and notes of all the best ornithologists in the county. The literary and scientific standard of the books devoted to county ornithology is clearly a rising one, and is no longer a matter only of conscientious compilation; records must be appraised, and where possible verified; information must be sought from those who never publish, and individual experience and observation must be the foundation of the volume. Not only must well-known collections be thoroughly overhauled, but how often one finds a rare bird, badly stuffed and cased, on the walls of an inn, or in the interior of a cottage! In the Introduction Mr. Ticehurst gives us a good account of the Kentish birds preserved in public and private collections, and there is another feature which should obtain hearty and general commendation. We read in the Preface: "Where a rare species has been recorded from a locality perhaps only a hundred yards beyond the actual boundary it would be absurd to exclude it from all mention in the present work." This removes one of the haunting suspicions one experiences in reading a county book on birds. A hedge, a stream, a lane may in places divide counties, and may thus limit a distribution or confine a record. Mr. Ticehurst has also pursued the clue of many recorded rarities, and has located the specimens, using all the perseverance of a trustworthy political agent in following up removed electors.

As regards the real material of the book, the history of the birds themselves, there is little doubt that a further note might be added here and there, but at the same time the reader will wonder how so much has been included; bird-lovers in Kent will find all they want, and if any supplementary notes are to be added there are opportunities for publishing elsewhere. Any young naturalist who carefully reads the pages will acquire much sound ornithological information, and he need not consider that this only applies to a Kentish reader. The illustrations are principally of the birds' haunts and breeding places.

In the Bibliography we find no mention of 'Greenwich Park,' by A. D. Webster, its Superintendent, and which was published in 1902. In this publication is given a list of eighty-one species of birds found there, thirty-four of which are said to breed in the Park.

Nimrod, Ramrod, Fishing-Rod, and Nature Tales. By J. WHITAKER, F.Z.S. H. B. Saxton, Nottingham.

MR. WHITAKER, who is well known to the readers of 'The Zoologist' as an ornithologist, has in this book shown himself to be an all-round sportsman, not only with the gun and fishing-rod, but also at the hunt and on the turf. This catholicity in pursuit gives these pages the charm of a naturalist writing as a sportsman, and a sportsman as a naturalist, and we hope that one day the author may give a larger volume of personal reminiscences derived from these varied experiences.

Visits to Selborne and Walton, with illustrations of the graves of both Gilbert White and Charles Waterton, will appeal to all naturalists. As regards the Cuckoo, some interesting points are detailed. Thus: "Early on in May the call is *cuc-koo*; about the middle of June it is *zuc oh*; after this the voice commences to break, and they call *cuc-cuc-cuc-ou*." Like many other field ornithologists, Mr. Whitaker is "no believer of the *March Cuckoo*," and he gives some amusing instances of the way in which this belief has arisen.

"A Winter's Day with the Perch" is one of those exceptional *opportunities* which does not come in the way of all anglers; but why were only worms tried? A small Gudgeon might have effected a revelation in such a water, and the writer has not yet forgotten the horror of hooking and losing the Perch of his lifetime with that bait at a weir on the Mole a season ago. "Seven Hundred Miles for two Snipe" is one of those experiences that befall all, the entomologist as well as the sportsman. Did we not at one Yuletide in the Transvaal drive eighty miles over heavy soddened veld to the proper locality and at the right time for the capture of four species of insects? We only brought two back, one of which was given to us and the other we purchased.

The illustrations comprise many varieties of birds, in which Mr. Whitaker's collection is known to be particularly rich, and the volume sustains its interest from start to finish.

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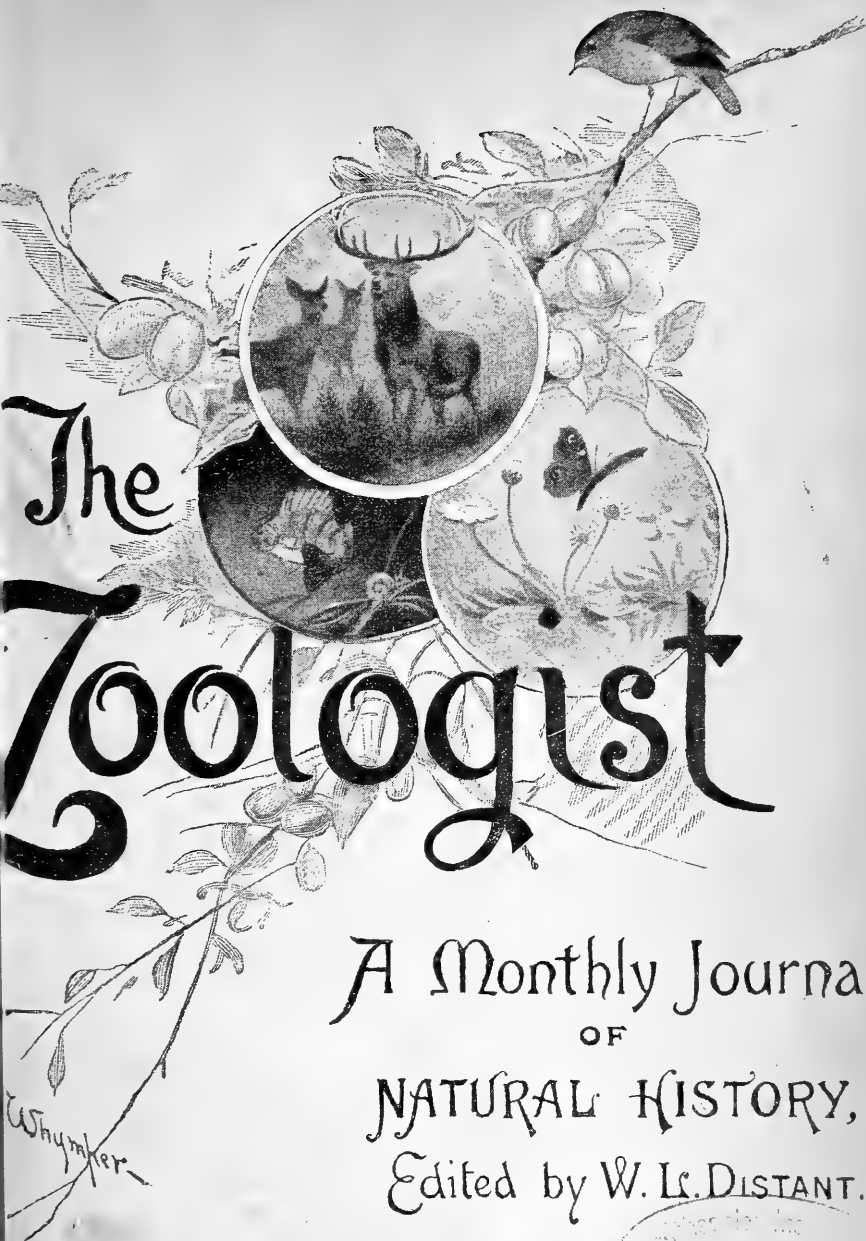
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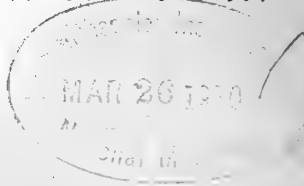
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No. 825.—*March, 1910.*

ORNITHOLOGICAL NOTES FROM DENMARK.

BY P. G. RALFE.

IN spite of the universal lowness of its surface, Denmark is a land of much beauty and of strong contrast. In West Jutland the long undulations—wave following wave to the far horizon—make a wide landscape, mysterious as the sea. Sometimes they are checkered with unfenced fields, intersected by ribbons of white road, and sprinkled with groups of low farm-buildings, thatched and timbered, round which cluster a few small trees. Sometimes they are clothed with the primitive brown heath, varied by equally desolate “moser” and “kjær,”* with their swamp-pools, or by the sombre brushwood of the new fir-plantations. The coast is a belt of yellow sand-hills (“klitter”), on whose harbourless shores beat the tempest-driven waters of the North Sea, and whose drifts ever threaten the dwindling crops that a thrifty peasantry tries to rear under their landward shelter.

But on the eastern side of Jutland, and in Fünen and Sealand, the land lies in wide sweeps of smiling pasture and corn-land, with far-extending beech-woods of the tenderest green, with still, meadow-bordered streams and lakes, with narrow firths and straits whose waters gleam among the foliage, a succession of idyllic pictures, until the one great city of the kingdom is reached at its eastern extremity.

* In Northern England “mosses” and “cars.”

Denmark is also a country of great archæological interest, whose remains of past ages are innumerable, and whose history in ancient and modern times is full of romance. Here, too, the visitor is amidst a friendly people, who are the more ready to receive an Englishman as such. In my own experience the only hindrance has been the language, for, though all more highly educated Danes speak some English (and German), and many are very familiar with our tongue, yet in remote places, which a visitor interested in birds often reaches, he is apt to find himself at a loss with the farmer or boatman or country inn-keeper. At the most interesting spots I had, fortunately, the company of Danish friends who spoke English well.

The avifauna of Denmark has great attraction for an Englishman, from the survival in its still extensive uncultivated lands of so many species—Avocet, Black-tailed Godwit, Black Tern, Ruff—which have ceased to nest in his own country. Until recently its forests also sheltered many interesting birds of prey—Sea-Eagle, Osprey, Kite, Buzzard, Goshawk, Peregrine Falcon*—but now these have been largely exterminated in the interests of game-preserving, and the many Raptores which in Denmark still fall to the gun of the keeper are mainly migrants from Scandinavia. In comparatively recent times the Cormorant, which here was a tree-builder, has ceased to breed. Of Continental species which seldom or never breed in England may also be observed in Denmark—the Icterine Warbler, Great Reed-Warbler, Marsh-Warbler, Eastern Nightingale, White and Blue-headed Wagtails, Little Owl, Wood-Sandpiper, Gull-billed Tern (the only colonies in North Europe), Red-necked Grebe, Little Gull (which here finds its western limit), and Turnstone, the last two, however, but sparingly.†

On the other hand, our mountain and rock-breeding birds are naturally, as residents, rare in or absent from Denmark. Such

* The Peregrine, however, was not common. The Common Buzzard is still comparatively frequent. The Hobby also still breeds, and the Honey Buzzard very sparingly. The Marsh Harrier, once common, is now very scarce. For many of these details I am indebted to Hr. Winge's articles "Fortegnelse over Danmarks Fugle" in 'D. O. F. Tidsskrift,' 1906-07, and "Danmarks Pattedyr og Fugle" in 'Danmarks Natur.'

† It seems to be doubtful whether the Caspian Tern now nests.

are the Dipper, Ring-Ouzel, Grey Wagtail, Merlin, Curlew, and Common Sandpiper;* and though Denmark has an extensive coast-line, the Guillemot, Razorbill, and Kittiwake. Other Gulls content themselves with breeding-places in marshes and sand-hills, and on remote islets in lakes and firths; Terns and the smaller Plovers nest abundantly on the shores, and the species of breeding Ducks are numerous, and their individuals plentiful in favoured localities.

The following observations on birds in Denmark were made during three visits to that country, in the early summers of 1907, 1908, and 1909. They relate principally to West Jutland, but the writer also made some excursions in the neighbourhood of Copenhagen. Though quite superficial† they may, as for long not much on Denmark has appeared in 'The Zoologist,' be of sufficient interest for publication.

Esbjerg, the only Danish port of any importance on the North Sea, is well known as a landing-place on the way to Copenhagen by many British visitors, few of whom probably spend any time on it. The new town, of bright and not unpleasing appearance, stands above a low but rather steep brow, whose sandy slopes are partly planted with fir-trees, and on which the high water-tower is a conspicuous landmark, overlooking harbour and roadstead, and across the narrow strait the shores of Fanö (except the very small Manö, a little to the south), the only North Sea island now belonging to Denmark. Fanö, about ten miles long and two or three wide at the most, is not unlike the English island of Walney in position and character, but it has, opposite Esbjerg, a good-sized little town (Nordby), and near the south end a smaller village (Sönderho). On the west or North Sea side, overlooking a magnificent extent of the smoothest, most level sand, is the watering-place of Fanö Bad, with its pretentious hotels and villas. The greater part of the island consists of uncultivated sand-hills, much like those of the Lancashire coast. These "klitter," in some places planted with conifers, but usually covered with ling and dwarf willow, crowberry, and sea-reed, with rose-heather in the marshy

* Of the first and the last two species a very few breed.

† Even in ornithology I was only on holiday in Denmark, and enjoyed, rather than investigated, its bird-life.

hollows between, are bright in May with wild pansies and needle-furze, and cheered by the song of innumerable Sky-Larks. Here, on June 1st, 1908, I found a considerable colony of Herring-Gulls breeding. The nests were chiefly placed on a somewhat flat piece of ground out of sight of the sea, and surrounded by lumpy heights. Most were empty; some had one egg, and there were broken egg-shells strewn about. The nests had evidently been robbed systematically (the previous day had been Sunday), and a man who came upon the scene resented my presence among the birds. It appears that most of the ground on which the Gulls nest is Government "Plantage," and this was the overseer or one of his men, but he was appeased when he found that I was not taking eggs. I was struck by the subdued demeanour of the parent birds here, compared with the noisy excitement shown at our own rock-colonies. My friend Hr. Klinge tells me that the Danish Game Law allows Gulls' eggs to be taken until May 25th.

At the north-west corner of Fanö is a beautiful expanse of the whitest sand, without mixture of stones or vegetation, called on the Danish Ordnance Map (Generalstabenskaart)* "Sören Jessens Sande," but most of the north end of the island consists of a level sward, under the sand-hills, of considerable width, beyond which are gravel-like banks formed of comminuted shells, past which again the muddy tide-flats, which on the inner side of Fanö replace the hard sand of the open west, stretch far out toward the lonely sand-cliffs of Skalling, on the other side of the channel, low but steep, which are crowned by a white lighthouse, and assume fantastic shapes in the mirage of a hot afternoon. The sward ("Grönningen") and the adjacent banks and tide-flats are rich in bird-life. Lapwings, Oystercatchers, Dunlins, Redshanks, and Ringed Plovers nest on the pasture, and on the flats outside are large numbers of all these species, in many cases perhaps migratory flocks and parties on their way further north. In 1908 I saw here also, on June 1st, some thirty Bar-tailed Godwits, some quite grey, some with the red nuptial plumage advanced. In various places on the north and west of Fanö, where the sward met the sand and became broken

* Finely executed and very cheap maps, rather confusing in the extreme abundance of very delicate detail by which they depict the land surface.

up among it into little islets of turf, I met with a few Kentish Plover, evidently breeding close at hand, but whether they had not yet laid, or whether from inexperience I failed in knowledge of the exact situation they preferred,* I was not able to locate a nest with eggs. I found many hollows apparently prepared, and the nests of Ringed Plovers and Oystercatchers on the neighbouring turf and gravel were easily found. A few Whimbrel were also seen on the west coast. Off Grönningen a few medium-sized Terns were evidently preparing to nest. (Hr. Klinge tells me that Little Terns, which I do not remember seeing here, also nest, and that the nests of the Kentish Plover, which are abundant, and at the time I was there should have contained strongly incubated eggs, are extremely difficult to find amid the small shells which surround them.)

There is a famous decoy on Fanö, on the eastern shore somewhat to the south, and a breeding colony of Black-headed Gulls, neither of which I have seen.

On the great bird colonies of the Ringkjøbing Fjord volumes might be written. Picturesque descriptions of the locality are to be found in Seebohm's 'British Birds' under "Avocet" and "Black-tailed Godwit," and in the appendix on Denmark to Abel Chapman's 'Wild Norway,'† and the never-to-be-forgotten scenes of its bird-life, bewildering to eye and ear in their variety and profusion, are well depicted by these authors. My visits have been too hurried to permit of any but the most superficial observation. The lands on which the principal breeding-places are situated are State property, and strictly preserved by the Danish Ministry of Agriculture, a step rendered necessary, it is said, mainly by the depredations of English collectors and dealers in former years. Every lover of birds will rejoice at the protection now afforded, apparently with the best results, to so wonderful a preserve.

The Fjord and its surroundings have changed often and much, even within the period for which historical record is available.‡ From an arm of the sea it has become a fresh-

* I was directed to the bird colonies on Fanö by Hr. M. Klinge, of Randers (formerly of Esbjerg).

† See also A. C. Chapman in 'Ibis,' 1894.

‡ For many topographical details about the Fjord I have consulted the

water lagoon, about twenty miles in length, shut in from the North Sea by a narrow tongue of sand-hills, and emptying by a very narrow and partly artificial outlet (Nymindegab) at its south-west corner. Into its southern part projects a promontory, about three miles long and one broad, called Tipperne (The Tips).^{*} This peninsula, little raised above the level of the Fjord, and itself almost a dead level, is clothed with verdure of the deepest green, almost without a flower (in May)[†] or a stone. In places it is bordered by muddy reed-beds, and intersected by channels of no great depth, while here and there on its surface are very shallow sheets of water. The Fjord itself is very shallow, never attaining twenty feet in depth. Much of it is not over knee-deep, and for long distances a cart can be driven through it. The depth, however, varies somewhat with the state of the Fjord's principal feeder, the Skjerna, a sluggish stream, which, flowing in many channels, enters it from the east, and also with the condition of the outlet, which is liable to be choked by sand from the outer sea.

On a fine day in May the landscapes of the Fjord are charming in their lonely simplicity. The level tongue of Tipperne, freshly green, stretches far away amid shining waters, across which, on the east, the low mainland shores are backed by cultivated country, bare of trees, but sprinkled with small farms, where the high white churches of Stavning and Velling are conspicuous, and, far away to the north, the grouped houses of the little market town of Ringkjöbing, no longer a seaport for vessels of any size. To the west, all along the horizon, lies the serrated line of the dunes on Holmslands Klit, the sand-spit which parts the quiet broad from the North Sea. On Tipperne itself there is hardly a sign of human occupation, but one sub-

interesting monograph of Dr. Rambusch, 'Studier over Ringkjöbing Fjord,' Copenhagen, 1900. A copy of this book was kindly sent me by my friend Hr. A. Hansen, of Randers.

^{*} I believe this name applies strictly only to the four extremities of the peninsula, "Store Tip" and "Lille Tip."

[†] Hr. Mentz (in Rambusch) says that the dominant constituent of this green carpet is *Juncus Gerardi* (Harrilgræs), associated with *Agrostis alba* and *Festuca rubra*. In the late summer *Aster tripolium* flowers very profusely.

stantial wooden building near the north end is used by Government employées, especially in summer, when the peninsula is farmed for grazing. In winter multitudes of Swans, Geese, and Ducks frequent the place.

I visited Tipperne from Tarm on May 25th, 1909, having, through the good offices of the British Consulate, obtained a pass from the Ministry. I cycled to North Bork, on the east shore of the Fjord, with Hr. Hvass, of the Realskole at Tarm, and Hr. Brink, who has an exhaustive knowledge of the bird-life of the neighbourhood. At Bork we got a boat to ferry us over to the peninsula, and then made our way to its extreme point, wandering over the even grass-land, and sometimes wading through shallow channels which separated one "Pold" from another, or outlying islets from what was, comparatively speaking, mainland.

Over the grassy surface of Tipperne breed great numbers of Lapwings, Ruffs, Redshanks, and Dunlins, and not a few Black-tailed Godwits, the nests of all being on much the same kind of ground, but those of Ruffs, Redshanks, and Dunlins better concealed than the others. The nests of Ruffs and Godwits were naturally most interesting to me; those of the former, like Redshank's, hidden in the more luxuriant tufts of herbage, containing the four richly-marked eggs; while the four dull-coloured eggs of the Godwits lay very open, the parents, which at the nest are very wild and shy, flying high overhead, and uttering their wild screaming notes.

On one of the driest parts of the peninsula were a good many nests of Common Gull, usually with their complement of three eggs, while a large colony of Black-headed Gulls centred amid thick-growing water-plants, and other nests of the same species were placed on an islet some distance out in the shallows, easily reached by wading. Most of the nests of the Black-headed Gull had recently been robbed, this being allowed to a certain date, and they now frequently contained one egg only. On the islet was a Pintail's nest with eggs, and there also Terns (a medium-sized species, probably *macrura*) were just commencing to lay, while others had selected some little spots of dry ground in a pond amid the grass of the mainland. In 1908 a large colony of Sandwich Terns had bred on open ground

close to and even just overlapping the chief settlement of the Black-headed Gulls. As usual with this species, they occupied a small area, where nests, or rather clutches of eggs, were closely crowded. But in 1909 we did not find them, and I was told that, like other Terns, they frequently shift the locality of their breeding-ground.

A still more interesting species was the Gull-billed Tern, large numbers of which, together with Avocets, occupied a remote part of the open grass-land, the nests of the two species being mixed all over the surface. At this time the nests of the Tern had usually three eggs, those of the Avocet four. The curious laughing cry of the large Gull-billed Tern, whose tail is but slightly forked, is very characteristic, and so are its eggs, which approximate somewhat in appearance to those of a Gull, being more elongated in shape and more uniform in form and colour than those of the Common and Arctic Tern. Mr. Chapman does not seem to have met with either this species or the Sandwich Tern here in 1893, though he saw the latter and another large Tern, which he failed to identify, on the outer sand-dunes. Dr. Rambusch remarks that while the Sandwich Tern, in accordance with its habits elsewhere, seeks its food on the North Sea coast behind the Klit, *S. anglica* goes eastward and inland, following the plough on the cultivated lands, like a Gull. The nests of both Gull-billed Terns and Avocets were of a very artless character, but other nests of the Avocet, on an artificial strip* projecting into the Fjord, were much more substantial structures. These curious and beautiful birds, so strangely attenuated in form, with their pure black and white plumage, shrill cry, and singular method of using their singularly-shaped bills, were abundant on Tipperne, guarding their nests on the grass, or wading with their long blue legs in the sunlit water of the channels.

On the great shallow of Stavning Grund, about half a mile from the middle of the eastern shore of the Fjord, the isolated Klægbanken, about two miles long by a few hundred yards in width, lies parallel with the mainland, from which, when the

* Such narrow dykes are constructed of sods for the purpose of reclaiming the space between them, as has been done on Tipperne to a considerable extent.

level of the water is low, it can be waded to. Klægbanken is clothed with dense aquatic vegetation (especially *Phragmites communis*, *Scirpus Tabernæmontani*). On its east side there is deep mud; on the west the ground is of a more sandy character, so that it is easy to walk along the shallow outside the vegetation.

On May 26th, 1909, I visited Klægbanken with Hr. Hvass, of Tarm. From Tarm we went by train to Lem (passing Deibjærg, famous for the discoveries of prehistoric waggons in 1881 and 1883), and cycled thence to Halby, on the shore of the lagoon opposite the bank. As far as Venner there was a fairly good road, but the last mile or two from Venner to Halby was extremely bad. When coming back we loitered too long at Halby, enjoying the kindly hospitality of the ferryman, who showed us a shorter track by which to return to Lem. At first we rode easily on hard field paths, but darkness overtook us among the ruts and sand-drifts of a terrible bye-road. My friend seemed accustomed to this kind of going, but for considerable distances I was quite unable to ride, and finally we arrived at Lem too late for the last train to Tarm. We found comfortable quarters for the night in the inn at Lem.

Though of less extent than Tipperne, Klægbanken is an even more singular place. So low that from the mainland bank it is scarcely noticeable, the green line grows upon the eye as you are punted over the channel, until you land upon the tussocks which rise from the mud, and are saluted by the screeching chorus of the thousands of Black-headed Gulls which are the feature of the islet, and whose nests are scattered or crowded almost all over its surface. Klægbanken is also very rich in breeding Ducks, Mallards, Shovelers, and Pintails, and Coots are numerous. As we blundered through the boggy reed-beds every few minutes we roused a Duck from its warmly-lined nest and full clutch of eggs. A patch of reeds had recently been burnt, and amid the blackened space was a nestful of Mallard's eggs scorched and cracked by the flames. Mallards seemed to me the most numerous of the Ducks, but their nests were less concealed than those of the Shovelers, which certainly were also abundant. A nestful of small Duck's eggs perhaps belonged to a Garganey.

At the north end were many Sandwich Terns, which, however, did not yet seem to be laying. I had not time to examine a large colony of the Great Crested Grebe, which I was told existed at the southern extremity. The most interesting of the inhabitants of Klægbanken are the Little Gulls, a small colony which has for some years nested here. Vegetation, according to Dr. Rambusch, began to clothe the bank in 1880; in 1905 the Little Gull was discovered breeding by Hr. R. Christensen, who announced the find in the 'Transactions' of the Naturhistorisk Forening of Copenhagen (1905, pp. 245-249). In its nest and eggs, as in its appearance and habits, the Little Gull is a miniature of the Black-headed, but the nests of the Little Gull here were on ground more open, at least in May, than what the Black-headed usually occupies, being flat, and covered only with a thin growth of rushes. It is to be hoped that the protection here afforded to this charming little species may lead to a further extension of its breeding-range in North-western Europe.

Some Gull-billed Terns breed on the more open part of Klægbanken, and we saw some pairs of nesting Redshanks, more than might have been expected from the nature of the ground; one nest with eggs was placed deep among the tall reeds. On the mud-flats were some immature Herring-Gulls, and a little flock of Sanderlings in changing plumage. Klægbanken is said to be entirely submerged in winter, and even in summer the extent above water varies very considerably. The mud in the shallows around it is full of large bowl-like hollows, which Dr. Rambusch says are caused by the wallowing of the Wild Swans, which, with Geese, Ducks, and waders, frequent the place in winter in immense numbers.

Both on Tipperne and Klægbanken I saw a few Common Sandpipers on migration.

The Skjernaa, as above mentioned, forms a delta, from the point where, between the twin villages of Tarm and Skjern, it is crossed by road and railway down to its outlet into the Fjord. This is a wide level tract of marshy meadow, its many water-channels bright, as they would be in England, with marsh-marigold and cuckoo-flower. It is also rich in bird-life. Godwits, Lapwings, Dunlins, Redshanks, and Ruffs nest on the

flat expanse in considerable numbers.* There are also small colonies of Black Tern. When in Skjernaadal on May 24th I was too early to see their nests, but by the end of the first week in June, as Hr. Brink informed me, eggs had been laid. The nests are usually in very wet places, difficult of access. The Great Snipe used to nest here also, but I do not know whether it still continues to do so.

In a marshy hollow with thickets of willow, which the Bork road crosses near Tarm, Hr. Brink pointed out a pair of the Wood Sandpiper. This species nests not uncommonly in such spots in this neighbourhood, and my friend told of a curious mishap which lately occurred to a hatching bird. A boy in jumping over the little stream landed right in the nest, killing the Sandpiper, and breaking all the eggs but one, which was brought to Hr. Brink, who kindly gave it to me. Hrr. Klinge and Hansen say that the species nests in nearly all the mosses from Ribe to Tarm.

From Copenhagen a very interesting excursion may be made to the island of Saltholm, about four miles long by one broad, and at its nearest point some five miles from the city. Saltholm lies in the Sound outside Amager, over which can be seen from it the spires and domes of Copenhagen, while on the other side are visible the smoky factory chimneys of Malmö, on the Swedish coast. Saltholm is very low, only indicated from the Amager shore by its houses and scanty trees. In winter it is liable to submergence; but, unlike Tipperne and Klægbanken, it has a floor of solid chalk, which sometimes comes to the surface, and was formerly quarried. There are on the island two sets of farm-buildings, one of them large and prosperous-looking, and it is used by the people of Amager as a summer pasture for cattle and horses. Most of it is covered with short, rich grass, which becomes longer and coarser toward the south end, where it is much broken by muddy pools and gullies, and ends at length in an extraordinary labyrinth of stony islets extending far out into the Sound, called Svaneklapperne. When first, in 1907, I visited Copenhagen, I had some trouble in finding out how to reach Saltholm, but was at last directed to Kastrup, the village

* Here Seebohm and Chapman found the Black-tailed Godwit breeding, as described in 'British Birds,' iii. p. 164, and 'Wild Norway,' p. 307, &c.

on Amager opposite to the islet. I went there on the morning of June 5th, and fortunately fell in with two residents of Kastrup who spoke English, Hrr. Nørregaard and Larsen, who kindly offered to accompany me, and arranged the hiring of a small sailing-boat. We landed on a quay near the north end of Salt-holm; on most parts of the shore the shallowness of the water makes access difficult. At the large farm near the landing we got a rude cart, in which we were driven to the southern extremity, bumping over knolls, and plunging into muddy channels. Then we wandered far out into a wilderness of water, boulders, and grass, with myriads of shrieking "Hættemaager" overhead, amid which hovered the graceful forms of the lighter Terns (*S. hirundo*), which share with them this nesting-ground. On the higher knolls, covered with grass, wormwood, and sea-lavender, were placed the nests of the Gulls, whose eggs at that time were just hatching. As we left each green skerry, another and yet another showed in front, each with its cloud of hovering Gulls, and we were still far from the extremity when the advance of time forced us to return to shore. On the rough grass-land were many nests of Common Gulls with eggs, scattered rather widely over the ground. I saw some Herring-Gulls overhead, and though I found no nests, I find from the account in the 'D. O. F. Tidsskrift' that a few of this species breed on Salt-holm. A few Sheld-drakes were visible, and many Oyster-catchers, nesting on marshy ground and amid the shallow pools. Ducks* flew to and fro, but I had no time to search for nests, and did not on this occasion stumble on any; I believe I did not reach their principal breeding-ground. Dunlins, Lapwings, and Redshanks were abundant over the pastures, and we saw several small parties of Ruffs, mostly seeming to have the "ruff" dark. There were Ringed Plovers near the north end of the island, where there are sandy pools, and near here I saw also one Turnstone. I learned afterwards that the latter species, which breeds in but few Danish localities (little outlying islets), is found nesting here in very small numbers.

On Saltholm, again, as on all the open lands of Denmark,

* The Pintail, Mallard, Shoveler, Teal, and Garganey nest on Saltholm; also the Eider in small numbers (I did not see any), and the Red-breasted Merganser (of which I saw a handsome drake).

were Sky-Larks in profusion ; the air was filled with their never-ceasing song, amidst the trilling of Dunlins, the squeaking of Lapwings, the fluting of Redshanks, and the croaking and screeching of the Common and Black-headed Gulls.

In spite of the inundations to which the island is liable, there are large numbers of Hares on it. Some low mounds have been raised as places of refuge for them, but the author of ' Danmarks Land ' says that on New Year's night, 1902, when Saltholm was completely submerged, four hundred were drowned, others taking to the buildings and even the trees in the little plantation.

The birds on Svaneklapperne are protected by a society for bird protection, " Svalen," but it is said that on the main island there is no adequate provision for their safety.

On June 11th, 1908, I made, with Hrr. Schioler, Christiani, and Landmark, a visit to a locality of a very different nature—that fine royal domain, the Dyrchave, to the north of the city. Here, in a high tree, Hr. Christiani showed us the nest of *Corvus corax*, which now is a very rare breeder in Denmark. Both the parent birds were still at the spot, and flew about with the fierce croaking so familiar at home ; the site recalled the ancient conditions of the nesting of the Raven in England. From the nature of the Danish country, its formerly numerous breeding-places there must have been principally in trees, but one is said to have existed on the curious isolated crag Skarreklit, on the north-west coast of Jutland. In another tree was a nest of the Honey Buzzard, which had probably been robbed ; the bark bore marks of climbing-irons, and the tenants were not to be seen. We had the pleasure of seeing and hearing a male of the little Red-breasted Flycatcher, which Hr. Christiani had already observed on a number of occasions, and which probably nested, though no nest was found. The species is very scarce in Denmark. We heard also Ring-Doves and Stock-Doves, and saw a number of Hooded Crows, the native crow of Denmark, which is found in all woods. In the hollow trees of the ancient forest nest, besides Stock-Doves, Jackdaws, Starlings, and Pied Flycatchers.

The low shores of Amager are a famous locality for migrating shore-birds ; I was not there at a favourable season for observing these, but noticed numbers of Oystercatchers, Redshanks, and

Sheld-drakes. In the neighbourhood of Amager Fælled, on dry, hard, stony waste just beyond the last buildings of the city, Hr. Christiani pointed out to me the three species of Ringed Plover—Common, Little, and Kentish—all breeding on the same ground. It would appear that birds must be comparatively unmolested by the Danish boy, or the nesting of these Plovers in numbers in such a locality, or that of the Ringed Plover and Little Tern on the much-frequented beach near Esbjerg, could scarcely continue. In an interesting article, illustrated from photographs, in the Danish Ornithologists' Union's journal, Hr. R. Christensen has described the nesting of the three species of Plover on somewhat similar ground at Frederiksholm Tileworks, on the opposite side of Kalvebodstrand from Amager Fælled.

With Hr. S. Saxtorph, of Hillerød, I visited the beautiful Lyngby Skov, in North Sealand, near Arresø, the largest Danish inland lake. This wood contains, in lofty oak-trees, a considerable heronry, of which Hr. Saxtorph has for years made a study; also a rookery, not just so common a thing in Denmark as in England.

Söborg Mose, near Copenhagen, though suburban villas are gathering around it, is still a breeding-place of many marsh-birds. A few Black Terns still nest there; there is a colony of Black-headed Gulls, and Hr. N. Christiansen, in his list of breeding species, includes the Red-necked Grebe and four species of Duck; also the Great Reed-Warbler.

Looking from the high-road, which passes close to the end of the moss, a casual eye would note only, among the cultivated fields and scattered houses, a narrow hollow with dense vegetation deeply green. But on approaching the edge a close growth of strong aquatic plants is seen to rise from water some four feet deep, and from thick mud below, forming a most impenetrable cover.

The place is now strictly preserved by the owners of the shooting rights, but in 1907 I made a voyage in a punt down the broad central channel which drains the marsh. My boatman was unwilling to leave this and push his boat into the tangle of surrounding reed and sedge, so that I saw little of the bird-life of the place; only the Reed-Buntings, Whinchats, and Yellow

Wagtails which frequented its margins; a flight of a Duck now and then to or from the cover; the many Reed-Warblers along the channels, a chance Snipe rising from my feet on a grassy knoll, a distant flock of Black-headed Gulls, and a few Black Terns passing Swallow-like on the wing. We reached neither the colony of Gulls nor that of Terns, which in the case of the latter was a considerable disappointment.

Of Danish small birds, I have not much to say. Most of the species familiar in the British lowlands are to be met with somewhat as at home. Chaffinches dominated in Dyrehaven, and, with other English birds of wood and garden—Finches, Warblers, and Thrushes—were abundant in such places as Christianslund at Nyborg, and the beautiful belt of woodland which covers the old fortification surrounding the pleasant town of Fredericia. I heard the Wood-Warbler in Lyngby Skov and in Kongelund; in Dyrehaven we failed to hear it on June 11th, probably on account of the late date, for Hr. Schioler tells me it is common there. The Nightingale (the Eastern species) is found in many places about Copenhagen. Tree-Sparrows I saw in several localities, including the suburbs of Copenhagen. Reed-Warblers were abundant in suitable spots, as Tipperne, Klægbanken, and Söborg, and Reed-Buntings frequent along the pools and ditches. I saw a few Goldfinches; the species is more common in Denmark than in Britain. Everywhere on the open lands of West Jutland and elsewhere the Sky-Lark, as already mentioned, was abundant; in West Jutland the Corn-Bunting was also a conspicuous bird.

The White Wagtail and the Blue-headed Wagtail were two species of special interest to an Englishman as Continental forms of familiar insular birds; the latter was especially frequent on the damp meadow-lands of West Jutland, and on the levels of Amager with the Whinchat, another common Danish bird. Everywhere along the coast I met with a few Wheatears, but never with a Stonechat (the latter is very uncommon in Denmark).

Common in every part of Denmark, and forcing itself on the attention of the most careless, is the Icterine Warbler, with its loud, cheerful, squeaking song and restless movements, frequenting the trees by the roadside and the shrubs in the gardens of

villas and cottages. Here and there I saw Red-backed Shrikes ; there was one in the little isolated plantation on Saltholm. Swifts and House-Martins inhabit the towns.

The Stork is a familiar and favourite bird in Denmark ; I once saw from the train a considerable flock in a meadow, and observed the great nests in various places on farm-buildings and houses in villages, principally in Jutland. Besides the above-mentioned colony of Herons, single birds were seen occasionally along streams and firths.

The only Golden Plover I have seen in Denmark was in full nuptial plumage in a field on Amager on June 5th, 1909 ; the species breeds sparingly on the heaths.

The following is a list of species observed by me in Denmark, with their Danish names. It is probably somewhat incomplete, as, having no intention of publishing, I did not always at the time make a note of the commoner birds observed, and now find no record, for instance, of *Accipiter nisus*, *Regulus cristatus*, some of the commoner Tits, and *Gallinula chloropus*, which must almost certainly have been seen :—

Turdus musicus (Song-Thrush) (nest). Sangdrossel.

T. merula (Blackbird). Solsort.

Saxicola oenanthe (Wheatear) (nest, eggs). Stenpikker.

Pratincola rubetra (Whinchat) (nest, eggs). Bynkefugl.

Erithacus rubecula (Redbreast). Rodkjælk.

Daulias philomela (Eastern Nightingale). Nattergal.

Sylvia cinerea (Whitethroat). Tornsanger.

S. hortensis (Garden-Warbler). Havesanger.

Phylloscopus trochilus (Willow-Warbler). Lovsanger.

P. sibilatrix (Wood-Warbler). Grøn Lovsanger.

Hypolais icterina (Icterine Warbler). Gulbug.

Acrocephalus streperus (Reed-Warbler). Rørsanger.

A. palustris (Marsh-Warbler). Kjærsanger.

A. phragmitis (Sedge-Warbler). Sivsanger.

Accentor modularis (Hedge-Sparrow). Jernspurv.

Parus major (Great Titmouse). Musvit.

P. cæruleus (Blue Titmouse). Blaamejse.

Troglodytes parvulus (Wren). Gjerdesmutte.

Motacilla alba (White Wagtail). Hvid Vipstjert.

M. flava (Blue-headed Yellow Wagtail) (nest, eggs). Gul Vipstjert.

- Anthus pratensis* (Meadow-Pipit). Engpiber.
A. trivialis (Tree-Pipit). Skovpiber.
Lanius collurio (Red-backed Shrike). Tornskade.
Muscicapa grisola (Spotted Flycatcher). Graa Fluesnapper.
M. atricapilla (Pied Flycatcher) (nest). Broget Fluesnapper.
M. parva (Red-breasted Flycatcher). Lille Fluesnapper.
Hirundo rustica (Swallow). Forstuesvale.
Chelidon urbica (Martin). Bysvale.
Cotile riparia (Sand-Martin). Digesvale.
Carduelis elegans (Goldfinch). Stillits.
Ligurinus chloris (Greenfinch). Svenske.
Passer domesticus (House-Sparrow) (nest). Spurv.
P. montanus (Tree-Sparrow). Skovspurv.
Fringilla cœlebs (Chaffinch). Bogfinke.
Linota cannabina (Linnet) (nest, eggs, young). Irisk.
Emberiza miliaria (Corn-Bunting). Bomlærke, Kornværting.
E. citrinella (Yellowhammer). Gulspurv.
E. schœniclus (Reed-Bunting). Rørspurv.
Sturnus vulgaris (Starling). Stær.
Pica rustica (Magpie). Skade.
Corvus monedula (Jackdaw). Allike.
C. cornix (Hooded Crow) (nest). Krage.
C. frugilegus (Rook) (nest, young). Raage.
C. corax (Raven) (nest). Ravn.
Alauda arvensis (Sky-Lark) (nest, eggs). Lærke.
A. cristata (Crested Lark). Toplærke.
Cypselus apus (Swift). Mursvale.
Ijynx torquilla (Wryneck). Vendehals.
Cuculus canorus (Cuckoo). Gjög.
Pernis apivorus (Honey Buzzard) (nest). Hvepsevaage.
Tinnunculus alaudarius (Kestrel). Taarnfalk.
Ardea cinerea (Heron) (nest). Hejre.
Ciconia alba (White Stork) (nest). Stork.
Tadorna cornuta (Common Sheld-drake). Grayand.
Dafila acuta (Pintail) (nest, eggs, young). Spidsand.
Anas boscas (Wild Duck) (nest, eggs). Stokand.
Querquedula circia (Garganey) (nest, eggs). Atling.
Q. crecca (Common Teal). Krikand.
Spatula clypeata (Shoveler) (nest, eggs, young). Skeand.
Mergus serrator (Red-breasted Merganser). Toppet Skallesluger.
Columba palumbus (Ring-Dove). Ringdue.

- C. ænas* (Stock-Dove). Huldue.
Phasianus colchicus (Pheasant). Fasan.
Perdix cinerea (Partridge). Agerhøne.
Orex pratensis (Corn-Crake). Engsnarre.
Fulica atra (Coot) (nest, eggs). Blishøne.
Charadrius pluvialis (Golden Plover). Hjejele.
Ægialitis cantiana (Kentish Plover). Hvidbrystet Præstekrave.
Æ. euronica (Little Ringed Plover). Lille Præstekrave.
Æ. hiaticula (Ringed Plover) (nest, eggs, young). Præstekrave.
Vanellus vulgaris (Lapwing) (nest, eggs, young). Vibe.
Streptilas interpres (Turnstone). Stenvender.
Hæmatopus ostralegus (Oystercatcher) (nest, eggs, young). Strandskade.
Recurvirostra avocetta (Avocet) (nest, eggs, young). Klyde.
Gallinago cælestis (Common Snipe). Horsegjøg, Bekassine.
Tringa alpina (Dunlin) (nest, eggs). Ryle.
Machetes pugnax (Ruff) (nest, eggs). Brushane, Skoggerkok.
Calidris arenaria (Sanderling). Selning.
Tringoides hypoleucus (Common Sandpiper). Mudderklire.
Totanus glareola (Wood-Sandpiper). Tinksmed.
T. calidris (Redshank) (nest, eggs). Rødben.
Limosa lapponica (Bar-tailed Godwit). Kobbersneppe.
L. ægocephala (Black-tailed Godwit) (nest, eggs, young). Stor Kobbersneppe, Rødvitte.
Numenius phæopus (Whimbrel). Lille Regnspove.
N. arquata (Curlew). Storspove.
Sterna macrura (Arctic Tern) (nest, eggs). Havterne, Kystterne.
S. fluviatilis (Common Tern) (nest, eggs). Terne, Hætteterne.
S. minuta (Little Tern) (nest, eggs). Dvergterne.
S. anglica (Gull-billed Tern) (nest, eggs). Sandterne.
S. cantiaca (Sandwich Tern) (nest, eggs). Splitterne.
Hydrochelidon nigra (Black Tern). Moseterne.
Larus argentatus (Herring-Gull) (nest, eggs). Havmaage, Stormaage.
L. canus (Common Gull) (nest, eggs). Stormmaage.
L. ridibundus (Black-headed Gull) (nest, eggs, young). Hættemaage.
L. minutus (Little Gull) (nest, eggs). Dvergmaage.
Podiceps cristatus (Great Crested Grebe) (nest). Stor Lappedykker.

In conclusion, I have to acknowledge the kind assistance of Hrr. A. Christiani, of Copenhagen, and M. Klinge and A. Hansen, of Randers, who have looked over my manuscript, and made various suggestions and corrections.

SUMMER IN LLEYN, WITH SOME OTHER NOTES ON THE BIRDS OF THE DISTRICT.

BY O. V. APLIN, F.L.S.

(Concluded from p. 50.)

THE shores of Lleyn west of Llanbedrog, the muddy harbour of Pwllheli and the long stretches of beach on either side of it left behind, do not afford much breeding-ground for shore birds, though a few Lesser Terns, Ringed Plovers, and Oystercatchers may be seen in Abersoch and Aberdaron Bays and in Hell's Mouth; the Oystercatchers, however, are more fond in summer of the stacks and islands, on all of which I noticed them. Aberdaron Bay has a sand and pebble beach of no great width, but it is broken into by the village, and boasts only of a few pairs of Ringed Plovers and Oystercatchers; the former have nested there, but I never knew the eggs of the latter actually found on the beach. That wide open bay called Hell's Mouth at first looks promising; but though at the eastern end under the base of Pen Cilan the beach is wide, and there is a good stretch of shingle, towards the west the shore narrows and the beach beneath those low, torn and battered earthy cliffs which is safe from the sea must be of small extent up to the end of the bay, where the rocks of Craig du cut off the low shores, and the empurpled heights of Rhiw spring so boldly in great steps above the rocks and woods of this corner of the wide bay, and make it the most beautiful spot on the coast of Lleyn. They are a glorious sight, even on a grey rainy day, with changing lights, when the heather, patched as it is with wide stretches of rich green fern, looms out a fine deep purple, and the slopes are brightened high up with a few sun-burnt pastures or a tiny barley patch already yellowing, and one or two brilliant white farmhouses. There was a flock of a dozen old and young Ringed Plovers here; and a pair which were very anxious, evidently

about some small young ones. Throwing themselves about in an altogether abandoned manner, lying down on their sides with one wing flapping weakly in the air and its feathers blown up by the wind, broken surely! The birds in fact were acting the badly wounded bird to perfection. Often as we may have seen the performance, who can help pausing to look at it again, wondering at this plain indication of thinking, or exhibition of thoughtful intelligence! When a clutch of eggs is the treasure it is enough to steal away quietly and unseen if possible. But when there are downy young to be considered the case is desperate; the man *must* be got away somehow. So this must run in the Plovers' broad bullet heads. Let us pretend we are broken-winged and helpless, so that he will think he has only to make a quick run forward to secure one of us (we *know* he would like to get hold of us). Struggle on a bit, lamely, and then tumble down again. He is following. If he makes two or three more rushes he will be led away a good distance. Now we have got him to a safe distance; no need to do more. So we will now go back, "pee-ep." And with their quick glancing flight they fly round us, and are again running over the pebbles not far from where we first caught sight of them. Surely there is reasoning power and thinking intelligence here? While sitting weather-bound under the stern of the 'Idea' of Carnarvon, thrown far up on this dangerous shore last winter, listening to the heavy roar of the tide flowing in over the quicksands, I saw three old Lesser Terns and half a dozen Oystercatchers. At the end of summer, at all events, food for little waders is very abundant on the sands. On hot sunny mornings near the tide edge Sand-hoppers swarm, especially near Aberdaron; as you walk along they jump up literally in thick clouds. There were a few little waders there sometimes. Ringed Plovers, young and old, a Sanderling, and a Dunlin or two, and also some Common Sandpipers, both there and at other places, rocky and sandy. At night I used to hear all these and also Golden Plover and Curlew. The last-named, like Peewits, were to be seen feeding on the grassy cliff tops and in the fields among the sheep.

Shearwaters, at this time of year at all events, when the Mackerel are in, are to be seen abroad until well on into the

forenoon. A boatman told me on the 27th that numbers of "Mackerel Cocks" were round his boat early in the morning; and the next day, about 8.30 a.m.—a calm, hot morning—some little way off shore where the Mackerel-boats were, I saw numbers passing up and down in parties of about a dozen. They kept a straight course for some distance, flying just over the surface. Now all flapped their wings together a few times, then all skimmed again. Presently all the little groups gathered in one place where they were very busy flying up and down and settling on the sea and rising again; they made a long black line on the sea and there must have been great numbers of them. I got a downy young one out of a hole. A most lovely little thing; the grey down which covers most of the bird—an inch and a quarter long on the back—is of a beautiful silky texture and of a darkish pearl-grey with almost a blue-grey tinge. The arrangement of the white on the under parts is very pretty. It is more than twenty years since my old friend the late Rev. H. A. Macpherson called my attention to it. Writing on board the s.s. 'Claymore' on his way from spending a week on Eigg, he sent me a sketch of a downy young one lying belly upwards. But as the young bird seems to be little known even now, I will complete the description of it here. The white starts at the chin, is continued down the neck and breast in a broad band to the upper part of the belly, here it divides, and, enclosing a patch of grey, joins again at the end of the body. Beak lead colour. Legs marked almost as in the old bird, but the colours less distinct. The little fellow uttered a lively "chirp" with a piping sound about it.

Almost all the Guillemots and Razorbills had left the cliff on St. Tudwal's with what young ones they managed to rear despite the Herring-Gulls, which rob them heavily. There were a good many on the sea between the islands. Of the few Guillemots left on the cliff only one or two had young that we could see (they are taken off when quite small). We also saw three eggs. The few that breed on Ynys Gwylan fawr had left the rocks, and were scattered over the sea a little way off; but there must have been some late breeding birds on the ledges at Pen Cilan, for when walking along the top I could hear the loud "arrrr" come up sometimes. The Shag is now *the* bird of the

rocky points jutting far out. Some Cormorants and Shags flew out of the big cave on St. Tudwal's as we passed in the boat, but I did not see any late Shags' nests. Some years ago I mentioned seeing a pair of Red Grouse on the Rivals, and it turns out that these mountains have long been known to harbour the *Iar Mynydd*. Writing of *Trer Caeri* and the Rivals, Pennant says ('Tours,' 1773-6), "The space on the top is an irregular area; part is steep, part flat: in most parts covered with heath, giving shelter to a few Red Grouse." The Grouse on *Rhiw*, if any remain, are said to be found about the north or north-east end towards *Sarn*; at the other end the bell-heather and dwarf gorse are so thick and close you can almost walk on the top of them in places—too thick for cover; there is little ling.

Apart from the late-breeding sea-birds, the end of July is a bad season for the ornithologist; but a little time then may be spent profitably in confirming one's impressions gained in spring of the status of the ordinary small birds. I found nothing new in that way. I saw the Red-backed Shrike again near *Mynydd Mawr*. Rock Pipits were very numerous on the islands. Stone-chats were numerous, and I noticed some on the bleak open table top of *Rhiw*. The Grey Wagtail haunted its old breeding-place in *Porth Saint*. The Nightjar ("*Troell*," the spinning-wheel) bred on *Rhiw* this year, and I heard two "turring" at *Abersoch*. A Starling seemed to be breeding late, for I saw it go down the chimney of the deserted building on *St. Tudwal's* island on the 24th. I was more than ever struck with the extraordinary abundance of the Blackbird, even at the far end of *Lleyn*, about *Aberdaron*. Walking from there to *Careg* (where woodland birds become more abundant) we passed on the roadside a long heap of very rotten farmyard manure, and flushed from it from a dozen to fifteen Blackbirds. They had scratched it down on to the road, just as if a score of strong yard hens had been at work. It was not an uncommon thing to come upon birds of the year skulking in ditches and little gullies and so tame that they merely shuffled their wings and cried "tuck, tuck" when you were close to them. House-Martins were local and rather scarce, but Swallows were in average numbers. They breed about almost any farm or deserted building. Down

on the north shore is a little sandy cove called Porth Oer, with Maen Mellt, a light-coloured rock as its name denotes, lying a bit off shore. A lonely spot, and not less lonely looking for a half-ruined shed with high-walled prison-like yard, built years ago to store boat-borne coal in when mining was tried here. A pair of Swallows had found this out, and had a nest with half-fledged young, and what appeared to be the first brood flying about. Maen Mellt appeared to be sometimes wave-washed and useless for birds. In the dreary-looking low earth cliffs of Hell's Mouth, torn and rent by the fierce winter storms, are some bands of sand. Here some Sand-Martins were breeding; the big fledged young hurriedly retreated from the mouth of a burrow when I looked in. The holes were deep. When sitting to enjoy the remarkable view to be had from the Cromlech at Cefn Amlwch (well figured by Cliffe in 'The Book of North Wales,' 1851), I saw a number of Wood-Pigeons coming out of a wood on the hillside and going into the barley and oats near. The view from the beautifully placed Cromlech is one of the best in this part of Wales, and includes Holyhead with the South Stack, the best view of the Rivals (all three heads), and the Bird-Rock backed by them; on the other side is Snowdon, and, further round, the Merioneth mountains. Carn Madryn, a fine isolated hump, lies just in front. The Peregrine reared young at two nesting-places near Aberdaron this year, and, as usual, nested on Pen Cilan, about one hundred feet above the sea and sixty feet from the top. The Barn Owl bred in a hole in a quarry close to Aberdaron, so far in that the eggs could not be reached with a stick, but Moles and Rats were raked out. On my way home I saw from the train on the Afon Wen meres Coots, Dabchick, Moorhen, four or five Teal and Redshanks. I have not been able to find out whether the last-named breed there or not. I heard one night at Abersoch what I am pretty sure was the hooting of a Tawny Owl.

I could not get to Bardsey myself this year. The big cliff looked as if it had been burnt brown by the fine weather. But Mr. T. A. Coward, who was on the island from June 14th to 16th, most kindly handed over his notes to me, with permission to make use of them. Mr. Coward saw six birds there which I did not, *viz.* the Stonechat, Swift, Redshank, Lesser Black-

backed Gull, Black-headed Gull, and Puffin. I had remarked with surprise the absence of the Stonechat when I was on the island. Mr. Coward saw a male in an excited state, and he felt sure that there was a female and nest somewhere near. It is common on the mainland. There were many Swifts about, but the nesting-place (if any) was not found. They wheeled round the mountain and high above the fields, but were not heard screaming round the farms. Many Puffins were seen about in the tideway close in-shore, and Mr. Coward suspected that some were breeding, but could not find where. On the other hand, they may have been fishing, and have belonged to the warrens on Ynys Gwylan not far away. Had they been breeding, some would most likely have been seen on the land at that date, or coming into or leaving the cliff. The other three species were probably stragglers. Mr. Coward also saw the Pied Wagtail (which I believed I saw), an old and young ones hardly strong enough to have flown from the mainland. But, on the other hand, he did not see eleven of the species that I saw. Four of these were probably stragglers, though it is possible the Common Sandpiper may breed. But the other seven I found fairly well established or represented, *viz.* Willow-Wren (a few), Spotted Flycatcher (several about farm gardens), House-Martin (several, but not breeding), Sand-Martin (a few), Goldfinch (a pair at least, and I believe more), Chaffinch (fairly common), and Cuckoo (several). And it is strange that they should have had such a poor hold on the locality. It is hardly possible that some of them at all events would be overlooked by so good an observer. We neither of us saw any Skylarks, Robins, Yellow Buntings, or Wrens, though I feel sure the last-named must be present. As Mr. Coward was there later in the season than I was (May 23rd to 24th) he found the Razorbill and Guillemot deeper in the business of breeding, and reports at least a score of pairs of the former, and at the same place (East-side) a long line of Guillemots on whitewashed ledges, fifty or sixty pairs at the lowest estimate, and he thinks more likely some hundreds. The Peregrines were still in possession. He secured a few Long-tailed Field Mice, a Common Shrew, and found the Palmated Newt.

I paid a very short visit to Lleyn in 1906 (May 29th to

June 4th), and, as usual at that time of the year, was much troubled with windy weather. Going out to St. Tudwal's Islands the evening I arrived, with the wind strong and gusty from the west, we found the sea so rough, especially under the larger island, that I really thought we should have been swamped, and we at one time thought we should not be able to get back that night; when we did, I had literally "not a dry rag on me." This is the worst of the Lleyn coast in May, when every day is precious to the bird-man. I suppose the examination of a clutch of six eggs (the only one I have heard of) of the Rock Pipit repaid me for a very unpleasant time. The nest was on a ledge of rock sheltered by grass and other plants. It was made of dead grass, and lined with finer grass and a little hair. The eggs were of the dark type. I may here mention that, shortly before, a clutch of (four) the beautiful pink variety of these eggs had been taken in Lleyn (17th), and sent to me. This variety is very rare. The wind was so bad when we were on the upper part of the island that we could not investigate very fully. A Herring-Gull's nest contained two very pale stone-coloured eggs with small well-defined spots. Peregrines had often been about the islands lately, and I saw one of the birds the next day on Penrhyn du. The Herring-Gulls on the cliffs about Pistyll Cim had nearly all got three eggs. The day after I arrived at Aberdaron, despite the surf which was plainly visible round the base of the islands, I tried to reach Ynys Gwylan fawr and fach, but the swell was too much for us. We landed one youth, who was particularly active, on the big island. A few Razorbills were breeding about a low overhung shelf, almost a shallow cave, and very difficult to get at. Three-quarters of the way up is a huge nearly horizontal crack or fissure in the black rock forming the back of the cave; inside this the birds were breeding. The youth, after creeping up the face of the rock like an expanded spider, crawled into the crack and brought out two eggs, reporting others so far in he could not reach them. We got him on board with difficulty; and found it impossible to land anyone on the small island. Two days after the wind was off shore at last, and taking four men in case the wind got up (which it duly did), I visited both islands. As I climbed to the top of the bigger one I saw a pair of Carrion-Crows rise and fly out with the crowd of

Gulls—an odd contrast in colour. We found the nest on an overhung ledge of rock (near the south end, where the island is very rugged) so detached from the rest as to make the nest very difficult if not impossible to reach. With a stick, however, we took the two fresh eggs it contained. The nest was a very slight affair for a Crow, with no more than a bed of dead plants and some cow-hair (which must have come from the mainland) and wool. The eggs were small and curiously brown—quite abnormal in fact. I am inclined to think that this pair were very old birds, which had chosen this unusual place to nest in thinking they would be sure of getting an easy living among plenty of young Gulls and eggs. The date, too, was extraordinarily late for fresh eggs, and might have been postponed for the same reason. I saw a great many Herring-Gulls' nests with two or three eggs; all seemed fresh or only slightly incubated. An Oystercatcher's nest with one egg was merely a hollow in the black soil of a cornice of rock and turf. The cries of this bird can be heard a long way off. One evening when I was on the headland off which the islands lie, the Oystercatchers thereon were for some reason very excited and noisy; their cries sounded surprisingly loud, although they were three or four furlongs from where I stood. Two Puffin's eggs I tried were one-third set upon in one case, and incubation begun in the other. There is a little grass on the outer island and much "spurrey" (*i. e.* seaside sandwort-spurrey or sea-sandwort, *Spergularia rubra marina*, or *Arenaria rubra marina*), of which, together with *Cochlearia*, *Armeria*, and grass, the Gulls' nests are chiefly built. There is a deep rift or chasm which nearly separates one part of this island from the rest; the bottom lies very cold and shaded and into this Seals are said to come. The Bardsey men have told me that in cold weather about Christmas, when they are crossing, they hear the Seals making a great noise round the islands, "crying like children." When we were going out in the morning, and standing out rather to the west of the islands, a Storm Petrel passed us flying towards the land. I was again assured that a man quarrying stone on the shores of the bay uncovered a small black bird sitting on one white egg.

I found a good many Puffins breeding all along the mainland,

from the east side of Trwyn y Penrhyn as far as Ogof Lwyd, and one or two Razorbills looked as if they were nesting in the cliff near the latter—a deep narrow inlet—where some Herring-Gulls sat on their nests. A pair or two of these seem to breed on the bare stack near Ebot off the shore here, and I think Oystercatchers too, but I did not go out to it. No sea birds seem to breed on Maen Gwenonwy. There are sheep on it, and I think you can get there by a causeway at low tide. A pair of Great Black-backed Gulls this year had built a big thick nest of scurvy-grass, grass, sea-pink, and spurrey on bare jagged rock. It contained three eggs, one of which was pale blue with lilac markings. Corn-Crakes were as common as usual, and one night I could hear two calling at the same time. The Red-backed Shrike inhabited one former haunt at least.

Drayton, in the ninth song of his "Polyolbion," mocks gently at the rivers of Lleyl:—

"Then further cause of speech the mighty Snowdon brake
 Least, if their wat'ry kind should suff'ed be too long,
 The license that they took might do the mountains wrong.
 For quickly he had found that strait'ned Point of Land,
 Into the Irish Sea which puts its pow'rful hand,
 Puff'd with their wat'ry praise, grew insolently proud,
 And needs would have his Rills for Rivers be allow'd :
 Short Darent,* near'st unto the utmost point of all
 That th' Isle of Gelin † greets, and Bardsey in her fall ;
 And next to her the Sawe, ‡ the Gir, § the Er, || the May, ¶
 Must Rivers be at least, should all the World gainsay."

The Daron is a pleasant stream at all events, and thanks to mills, although I can step across it here and there, it makes a respectable trout stream, its trout remarkable, it seemed to me, for the large size of the red spots on their sides. Salmon, too, run up the little river in floods, and a 12 lb. fish has been taken. The two high bridges in Aberdaron, which generally look absurd, spanning duck-polluted shallows where the water would not run into your boots, will, after heavy rain, hardly take the flood water coming down. The Daron valley running down the length of the far end of Lleyl for some distance starts shallow

* Darent = Daron.

† Gelin = Gwylan.

‡ Sawe = Soch.

§ Gir = Penrhos.

|| Er = Erch.

¶ May = Dwyfâch.

among the upland fields, where Peewits scream around you, and after burrowing down deeply through the high ground which overlooks the village, joins that of the Afon Mawr, and the united streams, rippling through the pebbles of the little beach, are lost in the surf-beaten sand. This little valley presents a great contrast to the wind-swept high ground on each side, and harbours birds which you might think you left behind when you penetrated the promontory by the high road which runs down its backbone. But its green meadows are often broken with bramble and other bushes, and its sides clothed with gorse and bramble and bracken and some shrubs. And near the fine old house and mill called "Bodwrdda" it is even wooded with low trees, chiefly ash, big enough to have Green Woodpeckers' holes in them, and for a Sparrow-Hawk to lay its eggs this year. One afternoon I noticed no fewer than four Chiffchaffs in song about the bushed sides of the valley. Linnets, Whitethroats, and Yellow Buntings of course breed anywhere about the cliffs when they are bushed; and indeed one ivied cliff a little way up the cwm of the Afon Saint, with some brambles at the foot, was inhabited by a Chiffchaff. But up the valley you find Mistletoe Thrushes (called here Caseg y Drychin = Mare of the bad weather), Song-Thrushes, not numerous in the rest of that neighbourhood, Spotted Flycatchers, Greenfinches, Sedge-Warblers, and Wood-Pigeons. There are Moorhens, too, and I put a bird off her seven eggs in the grassy bank at the edge of the stream. Nest, properly speaking, there was none, merely a hole in the ground very slightly lined.

A PRELIMINARY NOTE ON THE MANNER IN WHICH
THE OYSTERCATCHER (*HÆMATOPUS OSTRA-
LEGUS*) ATTACKS THE PURPLE-SHELL (*PUR-
PURA LAPILLUS*).

BY J. M. DEWAR.

THE Oystercatcher feeds upon the contents of the Purple-Shell to a limited extent it is true, yet sufficiently to justify its inclusion among the forces which control the numbers of this predatory mollusc. The opened shells which I have collected vary from three-quarters of an inch to one inch in extreme length from apex to base. The shells are detached from the rock with apparent ease. The Oystercatcher passes or forces its bill well under the shell, and by a quick lateral movement of the head tips the shell over so that the aperture looks upwards. In this position it is seized crosswise within the tips of the mandibles, and carried to a suitable place; it may be a little crack in which the shell is laid lengthwise, or a slight hollow in the rock, or very often a patch of firm sand. These advantages are optional, and room to work in seems to be the main object. Having set down the shell the Oystercatcher pushes its bill over the outer lip in a downward direction, introducing into the aperture the upper mandible alone. Through the point of the latter it administers a number of hammer-like blows, or, resting the point on the interior, a series of powerful thrusts, or pressing firmly and continuously it moves its head slowly from side to side, as if imparting a rolling motion to the shell in the direction of its long axis. If the bird is successful, a fragment is displaced from the under side of the shell. It is disc-shaped, and about a quarter of an inch in diameter. The edge may be straight, more usually it is bevelled inwards. The circular opening to which the disc corresponds is divided into two parts by the margin of the operculum, thus proving that the point of the upper mandible is pushed into the angular recess between the operculum and the inner wall. This marks the end of the first stage, and frequently it is never reached, many of the shells being strong enough to resist the efforts of the Oystercatcher.

The rolling motion to which allusion has been made can be demonstrated experimentally when the bill or other instrument is introduced into the aperture as near the apex of the shell as possible. The terminal portion rests in a vertical furrow, and when the upper end is oscillated in the direction of the long axis of the shell the latter rocks to and fro; as it rises on the apex the part directly under the bill, being unsupported, is driven out with moderate force in the typical form of a disc.

At the second stage the shell is turned over so that the normal aperture looks downwards or to one side. The Oystercatcher picks up and drops the shell to make it roll until it rests in the desired position. Usually one rolling is sufficient, but it may have to be repeated once or twice. From its form the shell can come to rest in one or other of two approximate positions—with the abnormal opening looking upwards, or with the aperture uppermost when the abnormal opening looks to one particular side. It cannot face the other side, because the shell will at once roll into its original position. When the abnormal opening looks upwards—perhaps the more common result—the Oystercatcher pushes its bill into the body whorl towards the ground and the apex of the shell, and then lowers its head in one swift, powerful movement. The outer lip appears to form the fulcrum of the lever. By its inclination away from the axis of the shell and by its sharp edge it resists the tendency of the shell to revolve. This resistance, however, must be increased by the line of leverage being as much as possible in the long axis of the shell. The methods applicable at the first stage may be used instead of that just described. When the abnormal opening looks to one side the Oystercatcher may employ that method, but a considerable part of the leverage will be wasted before the sharp edge of the outer lip bites the ground, and generally the methods of the first stage are adopted, the upper mandible alone passing through the abnormal opening, and travelling as much as possible towards the ground and the apex of the shell. Probably there is here an inclination towards the continuous pressure and rocking manœuvre. The result is strikingly uniform. A second piece of shell is driven out on the side of the first abnormal opening nearer the apex and further from the aperture. Nearly twice the diameter of the first disc,

it is a semilune, the circumference of the circle of which it forms part intersecting that of the first opening. The edge is either straight or bevelled inwards. This second and larger portion is found rarely in one piece. The greater part of the contents is now accessible. The mollusc is removed piecemeal, each part being seized and shaken from the shell in three or four mouthfuls. Just as the Oystercatcher may fail at the first stage, so it may be unequal to the second. In this event it removes through the first opening as much of the soft parts as are within reach.

On sand the shell sinks under the force applied to it with an inclination towards that side on which the force is greater, and one can learn indirectly by which method the force was applied. During the second stage a column of sand rises through the aperture to the first opening, and, adhering to the flesh, obscures much of it, or renders it distasteful. On the other hand, one may suppose that the yielding sand diminishes the shock which the bill has to sustain.

So far I have sketched what appears to be the general mode of attack, and what is certainly its common result when the attack is successful. The ideal result seems to be the extrusion of a piece of shell, equal in area to that of the two discs, at the first stage, so that the Oystercatcher can clear out the contents of the shell with the minimum of trouble. The extruded portion may be in one piece, or broken up into two or more fragments. The gap formed in the shell is irregularly pear-shaped or elliptical in outline, and does not show the symmetrical dentation characteristic of the type. Sometimes the Oystercatcher, falling short of its ideal as it were, is content to make the first small opening, and, without reversing the position of the shell, to remove a portion of the soft parts by poking its bill in from below.

As to the frequency with which the Oystercatcher attacks the Purple-Shell, my own experience indicates that the act occurs locally and very irregularly. Days pass, and no opened shell is seen on the feeding-grounds; on single days I have gathered eight or nine. A habit may be developed on parts of the extended coast-line of this and other countries, but there are reasons why it should not be. I happened to witness an Oystercatcher attack seven shells in succession. It failed to gain

access to four of them. One, after being submitted to a second bout of hammering, was picked up, shaken violently, even passionately, and then thrown away. To have four failures out of seven attempts is bad, and, though it is not truly representative, yet the average must be high, much higher than with Mussels, Limpets, &c. With these, if one may put it so, the Oystercatcher has a reasonable prospect of success, provided that it attends to what are presumably the conditions of success, and it can satisfy its wants with great rapidity. On the other hand, the Oystercatcher has no security whatever that it can open a Purple-Shell, and the process is apt to be infinitely tedious. The seven shells in the example I have given were dealt with in the space of about twenty minutes. In the same time an Oystercatcher can account for seven times seven Mussels with a fraction of the labour expended.

It may be noteworthy that the Oystercatcher appears invariably to carry the shell crosswise in the bill from the place where it was found to the place where it is to be opened, and yet holds it by the outer lip in making any subsequent movements. The relation of the bill to the aperture and the margin of the first opening during the application of force to the shell is also a little obscure. It is clear—in theory, at least—that if the shell be held firmly the under side will be crushed and impaled in the soft parts which are generally refused in that condition by the Oystercatcher. The evidence, however, both direct and indirect, points the other way. When it is hammered the shell does not rise with the bill between two successive blows, and it appears to have a slight mobility independent of the movements of the bill. The fragments are driven out and not inwards, which, in consideration of the mechanical construction of the shell, is by far the better plan. On the assumption that, to produce the desired result, the shell must be held loosely, it would seem simpler and more effective to put the point of the whole bill inside the shell, but I have not been able to assure myself that the Oystercatcher ever does so. At present, I suppose that the lower mandible is kept outside the shell for the express purpose of preventing or arresting any tendency to lateral movement. As long as the shell is rocked in the direction of its length it is perfectly steady, but its behaviour is uncertain whenever the movement takes the line of its shorter axis.

NOTES ON THE MAMMALS OF ISLAY.

BY HAROLD RUSSELL.

So little is known about the exact distribution of mammals in the Inner Hebrides that a few notes and observations on the fauna of Islay may be worth recording. Having visited the island on numerous occasions in the last twelve years, I attempted, in August and September, 1909, to trap and identify some of the smaller mammals. A reward offered for any Mice (other than House-Mice) brought to me by school children proved fairly successful. Foxes, Badgers, and Wild Cats are unknown in Islay. I have found no trace of the existence of Hedgehogs, Weasels, or Squirrels. Of all our small mammals, Moles are most easily detected if present, and I am satisfied that there are none in Islay.

Bats are fairly common, but I did not obtain any specimens, and all that I saw on the wing appeared to belong to the common small species, *Vesperugo pipistrellus* (Schreb.).

COMMON SHREW (*Sorex araneus*).—I obtained three Shrews, which I suspected belonged to this species, and Mr. Oldfield Thomas, of the Natural History Museum, South Kensington, was good enough to examine and name them for me. The measurements of the first one, freshly killed, were as follows:—Head and body = 74 mm. ; tail = 38 mm. ; hind foot = 13 mm. This, so far as I know, is the first time that *S. araneus* has been identified from Islay. Messrs. J. A. Harvie-Brown and T. E. Buckley ('Vertebrate Fauna of Argyll and the Inner Hebrides,' 1892, p. 8) state that the Lesser Shrew (*S. minutus*) is the species "which alone inhabits the Isles." This is certainly incorrect. I did not obtain any Lesser Shrews, but have no reason to believe that the two species do not exist together.

STOATS (*Mustela erminea*) appear to be fairly common, in spite of much trapping by keepers. They undergo great variety of seasonal variation. A collection of pure white skins made by

the keepers of Islay House has been made into a handsome garment of ermine.

OTTERS (*Lutra vulgaris*) are common, especially round the coast. The keepers believe that they travel between Islay and Jura, and seldom stay long in one place. There is a pure white skin preserved at Islay House. It was got from an animal killed a short time ago, and another white Otter was reported on the Sorn last summer. It is said that there is a third preserved at Kildalton House, which looks as though albinism was not uncommon.

COMMON SEALS (*Phoca vitulina*) are plentiful.

GREY SEAL (*Halichærus gryphus*).—I am told that a few pairs of this large and rare Seal still breed on a spot that need not be exactly specified. A short time ago a man named Macphee went there in a boat, and carried off two young ones, intending to rear and tame them. The enraged mother pursued the boat, and put her flippers over the gunwale, which so terrified Macphee that he let the little ones go. That these were young Grey Seals is borne out by the fact that this took place in October, when that species produces its offspring. *Phoca vitulina* breeds in May or June.

RED-DEER (*Cervus elaphus*).—There are two distinct herds of Deer on the island. The first inhabits the large woods round Islay House. The numbers are rigorously kept down by periodic Deer-drives. The herd seldom falls below ten, and has, I am told, sometimes reached thirty. The second herd is much larger, and inhabits the wilder and higher ground on the north-west side of the island. It probably numbers several hundred. Mr. Martin, of Dunlossit, told me that in 1908 twenty-six stags and nine hinds were killed on his ground. The Islay herds are frequently recruited by fresh blood from Jura, where there is a well-known forest. The stags constantly swim across the Sound.

FALLOW-DEER (*C. dama*) were introduced about a century ago by the Campbells of Islay. The herd at one time is said to have numbered over five hundred. Now there are less than one hundred, and the numbers are slowly decreasing. The Fallow-Deer rarely if ever leave the Kildalton Woods.

ROE-DEER (*Capreolus caprea*) are apparently indigenous, but not numerous. So far as I can discover there are none in the woods

round Islay House, and not many in the woods round Kildalton and Dunlossit. The increase of dogs, who destroy the helpless fawns, is said to account for some of the decrease, but in-breeding may also have something to do with it. So far as I know no Roe-Deer have been introduced.

LONG-TAILED FIELD-MOUSE (*Aprodemus sylvaticus*). — This species appears to be fairly plentiful. I trapped several in ordinary mouse-traps in the woods, and saw numbers of holes.

HOUSE-MOUSE (*Mus musculus*) is plentiful, and so are RATS (*M. decumanus*), wherever there are human habitations.

WATER-VOLE (*Arvicola amphibia*). — Messrs. Harvie-Brown and Buckley mention this species as possibly existing in Islay, but, as they suggest, the observer quoted was almost certainly mistaken. I have looked carefully, when fishing, for any traces without discovering them. At one spot on the Sorn I found a colony of brown land Rats who frequented the water's edge and had made holes.

FIELD-VOLE (*Microtus agrestis*). — A nest of three young Voles was discovered in a rick and brought to me. The old ones escaped. Mr. Oldfield Thomas named the young for me. The nest I sent to Mr. Charles Rothschild, hoping that some rare fleas might be bred from it, but I believe that nothing was obtained. I saw no holes that gave the impression of belonging to these Voles, and do not think they are common.

COMMON HARES (*Lepus europæus*) are not abundant. It is said that they were originally introduced. This is the only Hare in Islay.

RABBITS (*L. cuniculus*) are exceedingly abundant both in the woods and on the sand-hills round the coast. Enormous numbers are killed annually. Black varieties are common.

NOTES AND QUERIES.

MAMMALIA.

"Hardistrow," a Name for the Shrew.—I have recently noticed an attempt to connect the name "Hardistrow" (a name given to the Shrew) with "Harvest," through the name "Harvest-trow" given by Jefferies. It may therefore be well to point out that there is no connection between the two words. The form of this old name for the Shrew in local use in Oxfordshire is "Hardy-Shrew," or more commonly "Hardy-Mouse." It is a corruption of "Erdshrew" or "Erdmouse," and would of course be written "Ardymouse," if it were not for the English habit of putting in the letter "H" wherever possible. "Erd" is derived by Professor Bell from the Anglo-Saxon *Eorþ*=Earth; but we may get nearer the sound of our local name by comparing the Dutch word for earth, *aarde*. Hardyshrew or Hardymouse means simply Earthshrew or Earthmouse, and is a very appropriate name.—O. V. APLIN.

AVES.

Irregular Appearance of Blackbird.—It may be interesting to place on record the fourth annual visit of the White-headed Blackbird (*Turdus merula*) mentioned in 'The Zoologist' for 1908 (p. 312). In July last I began to look out for him, but he did not arrive till August 2nd. He remained as usual for a few days, and then disappeared till the middle of September; from that date he remained, and could be seen daily till early in November. At the time of his final departure he was really a remarkable-looking bird, his head and shoulders being snow-white, and the rest of his body jet-black. I can only hope that he will be as secure in his other places of resort as he is here.—R. H. RAMSBOTHAM (Elmhurst, Garstang).

Black-tailed Godwits in Cork Harbour.—Early last month (February) a flock of eleven Black-tailed Godwits revisited the mud-banks near Blackrock (the feeding-ground where they were seen by Mr. W. B. Barrington last October), and at my request a specimen was shot some days afterwards near Rochestown, about February 15th. This flock was evidently the same (the numbers being similar as those of the flock seen in October), but had probably between dates changed their haunts to some other part of the wide expanse of mud-banks of

that part of the Lee Estuary. It is, I believe, unusual for this species to remain for any time where they may rest when on migration. However, I think it may be assumed that this flock remained about the harbour all through the winter. This species visits the east and south coasts of Ireland much oftener than the west, where it is a very rare visitor, and has come under my notice only on five occasions during a period of forty years' wildfowl shooting in the Moy Estuary, Killala Bay. In May, 1863, I was shown a beautiful specimen in summer plumage, shot on the tidal part of the Moy between Castleconnor and Ballina. On Nov. 6th, 1876, I secured a bird in immature plumage by a shot from my punt-gun, by the same shot obtaining one Bar-tailed Godwit, thirteen Lapwings, and thirteen Redshanks. On June 29th, 1878, I observed a pair in the beautiful summer plumage among a flock of Bar-tailed Godwits on the sands near Bartragh, none of the latter showing any red. On Sept. 3rd, 1881, I was shown an immature bird, shot by a young friend on the sands near Roserk Abbey. This is all the experience that I have had of this species during my forty years' punt-shooting, and shows what a rare visitor it is to our west coast, where the Bar-tailed is so numerous, and many of them remaining all through the summer, none leaving the estuary sands for their arctic breeding-grounds.—ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Incubation and Fledging Periods in Birds.—As records of the periods of development of nestlings are even less frequent than records of incubation—although surely not of less interest—it may perhaps be worth while to set down what scanty notes I have been able to make on the subject during the last few seasons. Incubation periods are included for the sake of completion, though these are no doubt fairly well known, in the commoner species at all events:—

	Period of Incubation.	Fledging Period.
Mistle-Thrush	13-14 days	13-14 days
Song-Thrush	13-14 „	13-14 „
Blackbird	13-14 „	13-14 „
Whitethroat	11-12 „	11 „
Willow-Wren.....	12-13 „	13-14 „
Sedge-Warbler	13-14 „	13-14 „
Hedge-Sparrow	12-13 „	12-13 „
Dipper	15-17 „	?
Pied Wagtail	13-14 „	13 „
Spotted Flycatcher	13-14 „	13 „
Swallow	15-16 „	21-22 „
Greenfinch	13-14 „	13 „
Yellow Bunting.....	13-14 „	13 „

	Period of Incubation.	Fledging Period.
Starling	12-13 days	21-22 days
Magpie	17-18 „	29-30 „
Carrion-Crow	18-19 „	33-34 „
Rook	17-18 „	29-30 „
Long-eared Owl.....	28-30 „	? „
Sparrow-Hawk	30-32 „	28-30 „
Moorhen	19-20 „	— „

As individual birds vary to some degree in commencement and constancy of incubation, there is some slight difference in incubation periods to be observed at times. For instance, two Song-Thrushes, nesting close together in a shrubbery, commenced laying on the same day, laid the same number of eggs, and yet one bird hatched its brood at least twelve hours in advance of the other. Amongst Passerines laying is very regular as a rule, one egg being deposited each day until the clutch is complete. There are individual exceptions, however. For example, I have known an instance of a Grey Wagtail which laid two eggs of its clutch in regular course, missed the third day, and laid again on the fourth and fifth. Hawks and Owls are well known to lay only every second or third day. A Partridge, whose nest was kept under daily observation from the time it contained two eggs, took eighteen or nineteen days to complete its clutch of sixteen eggs. It is an interesting fact that some species of birds lay earlier in the day than others. Mistle- and Song-Thrushes, for instance, do not lay as a rule earlier than 8 or 9 a.m., according to my observations, and I have known a Mistle-Thrush delay until almost noon. Rooks also are late layers. Hedge-Sparrows, on the other hand, seem to lay either during the night or at daybreak. Swallows and Starlings are notable exceptions to the average small bird in the period required by their young to fledge. It is possible that young Starlings, if reared in an open nest, might fly at as early an age as young Blackbirds or Thrushes, but young Swallows have no impediment to prevent an early flight.—S. E. Brock (Kirkliston, West Lothian).

EDITORIAL GLEANINGS.

LAST autumn we received a circular on 'Swine Husbandry and Bacon Production,' by Mr. Loudon M. Douglas, Lecturer on the Meat Industry, Edinburgh, and for want of space have been unable to refer to it before in these pages. The following extracts are both economically important and zoologically interesting:—

"From day to day the evidence continues to accumulate showing that the bacon markets of the world are hopelessly disorganized, and that in so far as swine husbandry is concerned we are passing through a critical time. It is, in fact, a curious state of affairs, and calls for special comment not only from all who are interested in the prosperity of agriculture, but from those also who are specially concerned with securing steady markets in the provision trade. Apparently the shortage began about the beginning of the present year (1909), and has been more especially marked in the United Kingdom, but it exists also in the United States, Canada, and Denmark, these being the principal bacon-curing countries of the world. In the United States the outlook is indeed a serious one, not only for that country itself, but for the export trade. Actual records show, for example, that the number of hogs packed on what is known as the Western Markets, and which include Chicago, Kansas, South Omaha, St. Louis, Cincinnati, and other towns to the number of sixteen, as also smaller towns in the same territories, exhibit a very considerable shortage as compared with last year (1908). From March 1st to September 1st in each year the figures were as follows:—

Number of pigs packed on Western Markets, U.S.A.

1908	...	...	...	12,975,000
1909	...	...	...	11,735,000
Shortage	..	...	...	<u>1,240,000</u>

"Naturally, under such circumstances, we turn to our home conditions in order to see if anything is being done to avert the coming famine, and at the very outset are met with the figures from the preliminary statement just issued (1909) by the Board of Agriculture, in which the numbers of live stock in the United Kingdom are given. We find that there is a lamentable shortage of pigs as compared with last year (1908). The figures are as follows:—

Agricultural Returns up to June 4th in each Year.

		1909.	1908.
Sows kept for breeding purposes	...	316,552	369,476
Other pigs	... ..	2,064,335	2,454,006
Totals	... ..	<u>2,380,887</u>	<u>2,823,482</u>

"These show a decrease of 52,924, or 14·32 of breeding sows as compared the one year with the other, and a total decrease in the pig supply of Great Britain of 442,595, or 15·7 per cent. In so far as Ireland is concerned a very considerable shortage is also to be recorded here, and unfortunately one of the items is a smaller number of breeding sows of about 20,000.

"It will thus be seen that we have reached a perilous condition in so far as swine husbandry and bacon curing is concerned. The demand for pig products goes on increasing from year to year, and it seems difficult to understand why farmers do not endeavour to cultivate pigs to a greater extent. Year in and out they yield a larger profit than any other live stock, inasmuch as they can be fed on food which would otherwise be wasted. It is true that at the moment feeding meal is dear, but even at the present price of 9s. per cwt. there is a handsome profit in pig feeding. In ordinary times there is a good profit with pigs fetching 42s. per cwt. dead weight. Such a figure pays the farmer and pays the bacon curer. At the moment, however, the dead weight of pigs is about sixpence per pound, and in some markets rather more."

"A MILLION birds have been slaughtered each year for several years past in the Hawaiian Islands' bird reservation by Japanese, according to Captain F. D. Walker, of the Government cutter 'Thetis,' which effected a recent capture of Japanese on Midway Island. That island, and all others in the group with the exception of Laysan, are said to have lost practically all their once teeming bird population. There is no evidence of any marketing of birds' skins and feathers in Honolulu, says a despatch to the Toronto 'Globe,' the poacher's spoils, it is said, being sold by Osaka merchants in London, Paris, and New York. The bird poaching, it is believed, is handled direct from Japan. Japanese schooners, ostensibly in the shark-fishing business, are frequent callers in the bird island group, which stretches north-west from Hawaii. Capt. Walker says the birds were so tame on all the islands that they could be caught by hand. The poachers, he states, captured them, cut off their wings, and left the helpless creatures to die a slow death."—*Pall Mall Gazette*, Feb. 18th, 1910.

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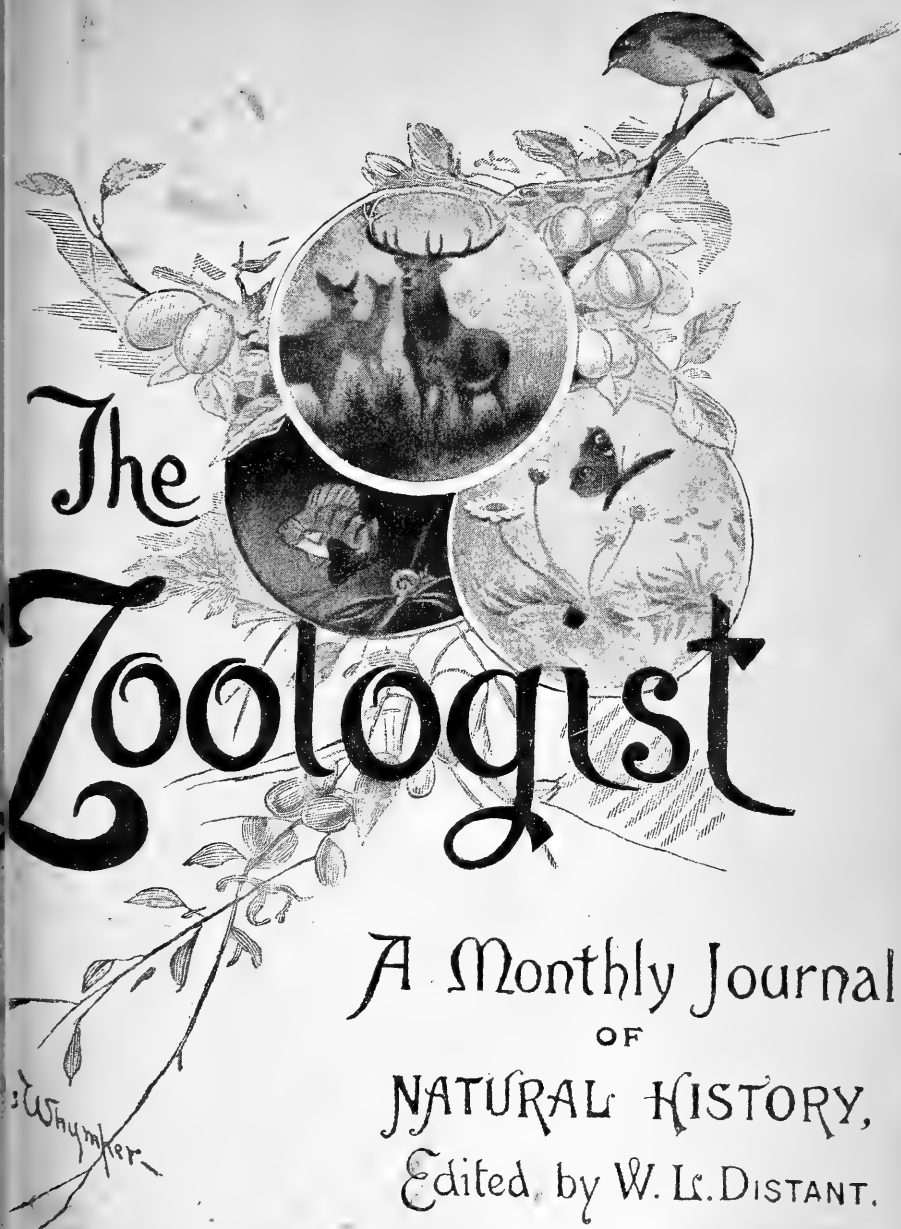
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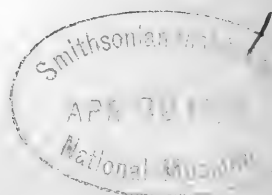
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SKY-LARKS AND STARLINGS AT CROMER LIGHTHOUSE.

THE ZOOLOGIST

No. 826.—April, 1910.

ORNITHOLOGICAL REPORT FOR NORFOLK (1909).

By J. H. GURNEY, F.Z.S.

(Assisted by other Norfolk Naturalists.)

(PLATE I.)

THE year 1909 had not any great surprises in store for the ornithological enthusiast, but Norfolk obtained visits from a few rare migrants, and our county, together with Suffolk, had its share in the great irruption of Crossbills.

The passage of Crows, Rooks, and Woodcocks in March, when the direction of their flight was northward and eastward, was marked, but the autumn migration presented no features calling for remark. Statistics and observations on the emigration of birds in spring are more needed than notes about their immigration in the autumn, for we have plenty of the latter so far as Norfolk and Suffolk are concerned, but exceedingly few of the former.

The principal rarities to be registered have been the flock of Black Brents in January, the Black-breasted Dipper in February, the Avocets and Alpine Swift in July, the Ortolan Buntings in September, and the Glossy Ibises in August and December. A Stork was doubtfully reported in the Wash, but that and the Flamingo and the Snow-Geese at Holkham may have been purposely turned-out birds.

1909 will be known as the "Crossbill year," for the irruption of these strange gipsy rovers, if not the largest as yet known, has at any rate been better recorded, with dates more

fully registered, both in British and in foreign journals, than any which preceded it. The first-comers were for the most part noted in places along the coast, and a few met their fate on ships. But it was amongst the great belts of Scotch fir and larch-wood in the south-west of Norfolk and the part of Suffolk adjoining that the later flocks were found. Here they became almost plentiful—particularly in the neighbourhood of Brandon, Thetford, Swaffham, and Didlington—and their ranks evidently continued to receive accessions up to Christmas, if not later. Indeed, the great feature of the 1909 movement has been the length of time it went on, in which it differed essentially from the great migrations of other species of birds; yet I imagine that these latest comers had worked their way to Norfolk by stages from other parts of England. The Crossbill has been a well-known Norfolk bird since the middle of the seventeenth century, but in looking through the late Henry Stevenson's notes I can find no record of any irruption like the present one. The last occasion when there was any number of these wanderers was in 1898, but the numbers then fell far below what 1909 has brought us.

The Luminous Owl.—Referring to the luminous Barn-Owl, which gave rise to so much controversy, it may be mentioned that it is still alive, or at any rate was so in February, and on the same property where it was before, but is no longer so bright as it was. Luminous Barn-Owls, I learn from Mr. L. Ternier, have recently (December, 1909) made an appearance in Spain, where two were seen.

I believe I said before that the figures which are employed in these Notes for denoting the force of the wind, are the same as used at the Meteorological Office. Force 2 is a gentle wind, force 4 a stiff breeze, force 6 a gale; but it has to be recollected that readings on the sea-coast give a higher strength than the same made inland. That anyone who wishes to study migration on the East Coast must take the wind into account I feel more and more convinced. It is a factor which has not been sufficiently considered hitherto by those who note the direction in which flights of birds are going. The rainfall for 1909 was 26·95 in.

I have to acknowledge the assistance of the Rev. M. C. Bird and Mr. E. C. Arnold in drawing up the following Notes.

JANUARY.

The year opened with a mild day ; the snow all gone. Beyond the presence of a few Goosanders, a brace of Whooper Swans seen by Mr. L. C. Farmer, and a Goldeneye at Hoveton, there is not much in my note-book to record. On the 21st the frost set in again, and on the 25th, with eleven degrees, a frozen-out Swant was seen to fly over Keswick, probably only a Mute Swan.

9th.—Mr. Bird notes twelve Long-eared Owls seen, a Greater Spotted Woodpecker, and a “trip” of Goldfinches, and two days afterwards five Goldeneye Ducks in their handsome adult plumage, which is only to be met with after Christmas.

19th.—During this month and the last days of December, 1908, Mr. F. Coburn, of Birmingham, obtained no fewer than fourteen examples of the Pacific, or Black, Brent Goose (*Bernicla nigricans* (Laur.))—of which a figure is given in ‘The Zoologist’ for 1908 (Plate I.)—from King’s Lynn, all of which had been shot in the Wash, and were possibly members of one and the same flock. Two of them were killed on Jan. 19th, and seven more on the 26th. This is a valuable series, as Mr. Coburn has now all grades from the first plumage without any white on the neck up to adults of both sexes. He now considers that at all ages and seasons, and in both sexes, the black or slaty-black under parts are constant, and that after the first plumage there is always a larger amount of white on the neck. He finds females to be of a paler slaty black than males.

29th.—An adult Iceland Gull, shot on the Thurne, near Yarmouth, as I learn from Mr. E. C. Saunders, who also informs me that a younger one was killed near there on the 20th, but I have not seen these.

FEBRUARY.

1st.—The Pied Wagtail returned to Keswick with its accustomed regularity, and, as signs of spring, on the 4th the Sky-Lark and Robin were in song at Brunstead.

10th.—A Black-breasted Dipper shot at Coltishall, where it had been about for several days (S. H. Long). Mr. Barclay informs me that his keeper’s dog put up a Bittern when searching a reed-bed at Hoveton for a wounded Duck. Of course it was not shot ; indeed, there is now a general desire among Broad-owners to protect Bitterns.

MARCH.

7th.—Mr. G. Jary reports nearly two hundred Wigeon on Breydon Broad; migrants no doubt, probably travelling north.

11th.—N.E., 3. Rooks and Grey Crows migrating to the north, *i. e.* against the wind, at Catfield (M. C. Bird).

18th.—S., 3. From 7.30 a.m. to 11 o'clock Grey Crows were passing Northrepps, which is one mile from the sea, flying towards the south-east and against the wind. This movement seaward takes place every year as regularly as March comes round. The same observer saw them again on the 23rd and 25th, and on April 1st, mingled as usual with Rooks and Jackdaws. We know far less about the spring migration than we do about the autumn immigration of birds, but about the *Corvidæ* we do know something at this period.

19th.—S.S.E., 3. Sky three parts clouded, passing showers.

20th.—S.S.W., overcast and misty. A great number of Sky-Larks and Starlings at Cromer Lighthouse, attracted in the usual way by the light shining through the fog, in the rays of which they fluttered around. Mr. Pender, the principal, tells me that one hundred and forty-four Larks and four hundred Starlings were taken at the lantern by his men, and that the four stays of the flagstaff, which stands some twenty feet away from the lighthouse, were simply packed with birds. So many of them were there that the Starlings were sitting one upon another on the stays, while a bunch on the top of the flagstaff gave it the appearance of being surmounted by a large bowl. There were also Plovers and Curlews flying round, but none of these came in contact with the glass. A heap of the slain are shown in the photograph (Plate I.). I believe the men make them into pies.

21st.—W., overcast. Last night, as well as the night before, Happisburgh Lighthouse, which is eleven miles from Cromer, presented a similar spectacle, namely, a congregation of birds which had lost their way in the fog. I learn from Mr. Gentry, who is in charge, that the gallery around the lantern, as well as the rails, was packed with Starlings, but no mention is made of Larks. Lapwings and Curlews were also seen. All these birds were probably on their way out to sea, and about to leave this country for the summer.

27th.—W.N.W., 2. Nearly thirty Woodcocks flushed by the gamekeeper at Northrepps, the most he ever remembers putting up in a day; they probably came with the high north-west wind (force 5) yesterday, and were waiting for a change before passing the North Sea. They were not molested, and after this year Woodcocks will be protected in Norfolk from Feb. 1st.

31st.—About this date a drake hybrid between the Nyroca Duck and the Pochard†—a cross to which Bartlett gave the name of *Fuligula jerinoides*—was received by the Hon. E. S. Montagu from near Potter Heigham.

APRIL.

18th.—S.W., 2. My only entry for April is that the first Spoonbills, three in number—spring migrants, true to their usual time of coming—were seen on the mud-flats of Breydon Broad, where Mr. Jary had them in view off and on until the 29th, and carefully protected them from all roving gunners. On one occasion they even had the temerity to alight on the Marine Parade (A. Patterson), but no one violated their security. At the same time one was seen at Cley by Mr. Pinchin.

MAY.

1st.—N.N.E., varying to N.W. Two more Spoonbills seen by Jary, probably not the same as those which left Breydon on the 29th.

6th.—A north-easterly gale, force 6. Mr. Jary writes:—"This morning I counted one hundred and ninety-six Bar-tailed Godwits and Grey Plover in one flock on the mud-flats; wind east, from which quarter it has been blowing for several days, and very strong." What effect the gale had at Cley and Blakeney I was not informed, but inland Ruffs and Reeves felt it, for Mr. Bird tells me that there were quite one hundred on one of the Broads the following day, as well as a Greenshank, an Oystercatcher, and some Cormorants. It is only to be expected that birds should be brought up in their course and detained by a gale, which stops all their intended nocturnal progress overhead, and consequently they descend to the muds and marshes, and have to wait until it abates. The wind was still very high on the 7th (E., 5) and 8th, and from the east. On the 8th the Breydon watcher writes again:—"A great many birds here now,

more Bar-tailed Godwits than I ever saw before, some Green-shanks, seven Sheld-Ducks, scores of Whimbrel and Knot, and plenty of Dunlin and Ringed Plover." These Godwits were presumably the return passage of the unusual numbers registered as passing during the previous autumn (*cf.* Zool. 1909, pp. 123, 128).

17th.—A Long-eared Owl squatting on the ground at Colney was found to be covering a young one,[†] which had had the ill-luck to fall out of its nest in a spruce-fir hard by. On examination the nest was found to contain another nestling, which was dead, but the one on the ground had been well cared for and was nourished, a dead Thrush lying beside it for the next meal.

31st.—*Cuckoo Notes*.—About a quarter to eleven this morning a Cuckoo was calling loudly on a tall beech-tree by my front door, with that peculiar bubbling intonation which is the characteristic of a female. About forty yards away there stands an ivy-clad garden-wall, and at 4 p.m. the coachman, whose window overlooks it, saw a Cuckoo—no doubt the same one I had heard—searching this wall. Several times she was seen to hang on to the ivy, evidently peering into its interstices in different places, and twice the coachman saw her alight on the ground, as if giving up her search for the present. Meanwhile the Pied-Wagtails, whose nest containing one egg was deftly hidden in a recess in the ivy at the top of the wall, were looking on, but whether with indignation or with simple curiosity it is hard to say; neither do we know whether the Cuckoo discovered their nest, which was unusually well hidden.

June 1st.—The coachman, who at my request instituted a watch, began taking observations from his window at 6 a.m., but the Cuckoo was not seen to come to the ivy. There were two Wagtail's eggs in the nest when we looked into it at 9 a.m.

2nd.—Three Wagtail's eggs now in the nest.

3rd.—At 7 a.m. the coachman heard the Wagtails calling, and at 9 a.m. the nest contained the expected Cuckoo's egg, as well as the three Wagtail's eggs already mentioned, all four bearing a close colour resemblance to one another. The Cuckoo's egg had probably been deposited in the nest between 6.30 a.m. and 7 a.m., and it was that which excited the Wagtails.

4th.—There are now four Wagtail's eggs.

5th.—There are five Wagtail's eggs.

6th.—Female Cuckoo heard about fifty yards from the nest at 10.30 a.m.

7th.—Female Cuckoo heard at 4.30 p.m.

8th.—Nothing to record.

9th.—Early this morning we found that two of the Wagtail's eggs had been removed from the nest; they were gone at 8.45 a.m., there being then left in the nest three Wagtail's eggs and the Cuckoo's egg. Nothing was seen or heard of the female Cuckoo, but the coachman, once at least, detected the cry of the male "cuckooing" on the beech-tree near; whether he was the robber or whether the female Cuckoo took the eggs it is impossible to say. At any rate, one of the eggs was not carried far away, for I found half its shell, yolkless and neatly divided, suspended in the ivy some two feet below the Wagtail's nest.

10th.—At 12.45 a.m. the female Cuckoo was calling about a hundred yards from the nest.

11th.—The Cuckoo not heard.

12th.—The Cuckoo was on the beech-tree once at least.

13th, 14th, 15th.—The Cuckoo not heard, and on the 15th I had to leave home.

16th.—Mr. Gerard Gurney found one of the Wagtail's eggs hatched, but the other eggs not sprung; it had been hatched between 7.30 a.m. and 5.30 p.m. A Cuckoo flew over the wall in the morning.

17th.—At 6.30 a.m. the coachman found that the Cuckoo's egg was hatched, and that a second Wagtail's egg had been hatched also. As this Cuckoo's egg was laid on June 3rd its incubation is proved to have been fourteen days. At 6.30 p.m. the third Wagtail's egg was also hatched.

18th.—Looking at 6.30 a.m. the coachman found that one of the nestling Wagtails had been cast out of the nest, the age of the young Cuckoo—which may or may not have done the work of ejection—being then twenty-four hours. At 9.30 a.m. a second Wagtail was lying outside; both were dead, but it is certain they had not been dead long, for their bodies were not yet cold. At 11 o'clock the third Wagtail had been cast out, and was lying about an inch from the nest, and still alive. That the

young Cuckoo had thrown this one out is almost certain, though no one saw it done. At 11.30 a.m. Mr. Gerard Gurney put back the nestling Wagtail, which was still alive, into the nest, and reported events as follows :—After ten minutes the young Cuckoo began to get restless and to fidget, and soon tried to expel the little Wagtail, working round and round the inside of the nest by an active use of both legs and wings, but all its efforts were unavailing, and it did not get the Wagtail out. The young Cuckoo took repeated rests, even for as much as ten minutes at a time, lying quite still with the Wagtail resting on its back, but if the latter slipped a little the Cuckoo would move. The young Wagtail had not been ejected up to 3 p.m., but at 4.30 p.m. it was again outside the nest, lying exactly where my son had found it in the morning. I am inclined to attribute its expulsion to the parent Wagtails, as the young Cuckoo was exhausted.

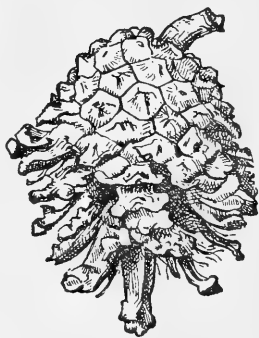
JUNE.

1st.—Under this date Mr. Bird sends me a curious instance of a Brown Owl and a Kestrel having laid their eggs in opposite sides of an old Pigeon-locker, which had been erected on a tree in a Horsey osier-ground.

3rd.—A nestling Hawfinch† picked up at Keswick, but, although it seemed impossible that it could have flown many yards, search failed to discover the nest.

18th.—Mr. Cresswell informs me of a Flamingo being seen at Wolterton Creek, in the Wash, possibly one from the Zoological Gardens, the escape of which was announced in April (R. Pocock). A London newspaper also published the shooting of one on Mersea Island, Essex, in September, and Mr. Louis Ternier saw one on Nov. 30th in the bay of the Seine, which is opposite the Isle of Wight. It is difficult to say where they may have all come from; the Duchess of Bedford has not lost any lately, but other people may have done so. Mr. Ternier heard of another killed in Vendée about November ('Revue Fr. d'Ornithologie,' 1910, p. 153). Mr. W. A. Harding, who keeps Flamingos, lost two in 1906 and one in 1907, but none in 1909. There seems no reason why it should not visit us sometimes as a migrant, being not uncommon in the South of France, where I have seen it.

21st.—*Migration of Crossbills*.—The first intimation of the great Crossbill immigration having reached Norfolk came from Mr. E. C. Saunders, who had one which had struck the telegraph-wires near Yarmouth on June 21st. No more were reported during that month, but on July 8th the gardener at Northrepps counted twelve on a spruce-fir. The following day a male occurred at Stalham (Bird), and on the 10th the flock at Northrepps had increased from twelve to sixteen. Although constantly looking out for them, it was not until Sept. 22nd that I obtained my first view of three feeding on a young larch-tree at Northrepps. These soon disappeared, but on Oct. 26th the same small plantation was visited by a much larger flock, my gardener, whose attention was first attracted to them by their notes, counting twenty-five. During November and December a good many were seen in South-west Norfolk, where there is a good deal of uncultivated country, and plenty of fir-trees. Near Thetford they appear to have been almost common (W. G. Clarke), while there were many in the neighbourhood of Swaffham (E. T. Danberry), and at Didlington (Upcher), and some at Castle Rising (Tracey). I watched a pair on Jan. 2nd at Thetford. It is always an engaging sight to watch their parrot-like ways. One of them detached a good-sized cone from a young Scotch-fir, and flew with it in its beak from the fir-tree on which it had been perched for several yards, but, again alighting, began slowly pecking the cone to pieces, holding it the while with one or both feet, while its strong mandibles brought point to point (though this I was not near enough to distinguish) prised off the scales. Its actions in dealing with a cone display great muscular strength, and there is hardly any attitude which Crossbills are incapable of assuming. After some minutes the cone was dropped, and I picked up what I believe to have been the same one, of which Mr. Wilson has made a drawing. On examination it does not seem very dissimilar from a cone dealt with by a Greater Spotted Woodpecker, which was drawn in a former



paper (Zool. 1902, p. 95), and that also was off a Scotch-fir. On Jan. 31st they were again seen at Northrepps—a little flock of five—but in a different wood from the others, and they were soon on the wing. No more were detected in that parish until March 2nd, when eight were seen by Burdett. Remarkable as the great irruption has been, the most interesting fact connected with it has been the breeding of four pairs at Thetford,* and of seven pairs at Aldeburgh, on the coast of Suffolk ('The Field,' March 5th, 1910), and that they also bred in other parts of Norfolk is highly probable.

29th.—N.E., 2. Another Spoonbill on Breydon Broad, where it remained until July 8th, and was again seen by the watcher on the 22nd, 29th, and on Aug. 3rd and 8th.

JULY.

15th.—It is seldom a year passes without a visit from an Avocet to Breydon tidal Broad, and accordingly one was seen to-day (G. Jary). The watcher saw it again on the 18th and on the 29th, and on Aug. 3rd, but on the 4th it had gone. On the 8th, however, it returned with two more, but he states that they only stayed about two hours, for, it happening to be a very high tide, there were soon no muds left for them to stand upon. Perhaps it was the tide which had already flooded them off their feeding-grounds in Holland. The watcher saw them flying away to the eastward; wind east, fog coming on.

25th.—Between the 25th and the 31st an Alpine Swift was identified by Mr. Mussel-White on several occasions; it was flying up and down the Cromer cliffs, just the same place where one was seen in September, 1890. This species usually follows coast-lines, which is perhaps the reason why it has only been once obtained in Heligoland.

AUGUST.

3rd.—Mr. Bird put a young Marsh-Harrier up from the sedge adjoining one of the Broads, which he had every reason for believing was a locally bred one. A pair of Montagu's Harriers probably nested at Hockwold Fen, where Mr. Upcher tells me they were seen about during the summer, and two pairs had eggs in East Norfolk, but no young. However, they maintain their hold pretty well, and I was credibly informed of eight

* 'British Birds,' iii. pp. 302, 371.

being seen on one day in May, of which six were grey males. In the Broad district, where they have undergone the chief persecution, I am glad to learn from Mr. Montagu that a scheme is on foot for their protection, and none too soon.

13th.—Under this date one of our coast watchers, where there is a Tern settlement, writes to my nephew, who is secretary of the fund, giving a good account of the birds under his charge. There are, he writes, still several Tern's eggs left unhatched, and not rotten ones either, as in some of them the young ones can be heard inside; also there are several young of the Common Tern about on the shore, which are still incapable of flight, as well as young ones which can fly, besides a fine show of adults of both this species and the Lesser Tern. A satisfactory report showing what protection can do.

19th.—A young female Golden Oriole,† a species which very seldom comes to Norfolk now, shot at Cley, but not anywhere near the sea. The explanation of the growing scarcity of this beautiful migrant seems to be that those Orioles which used to come to East Anglia were birds which had wintered in Spain, Sicily, and Italy. Now these have all been shot, and those which winter further south—that is, in Africa—do not travel as far as England, their proper limit being the North of France. The same reason explains the disappearance of the Hobby, which is hardly ever seen in Norfolk now, and accounts as well for the scarcity of the Hoopoe.

20th.—The irruption of Greater Spotted Woodpeckers reported at Rossitton, in the Baltic (*cf.* 'The Field' of Sept. 11th), led naturalists to expect them in England, but the number in Norfolk has not been much in excess of their usual strength. The first date to hand is "Northrepps, August 20th," and another the next day, and another at Hanworth. Mr. Pashley had one brought him which had been shot close to the sea by a man who was digging for worms on the muds, and I watched another† which seemed to have just arrived. It is curious that among so many migrations of this species we should never have met with an instance of the Green Woodpecker crossing the sea, nor has it been obtained in Heligoland.

28th.—No wind. Two Glossy Ibises seen by the watcher on Breydon Broad had gone the next day.

SEPTEMBER.

11th.—*Perplexing Autumnal Movements.*— Among the rush of small migrants last year the Ortolan Bunting was not included, nor do I remember having heard of any since September, 1904, in Norfolk or Suffolk, but this has been made up for by the presence of a small flock on our coast during the present month of 1909. The first one was identified by Mr. F. Richards on Sept. 11th, and others were seen at intervals up to the 23rd; certainly eight or nine altogether were identified, and some shot. Mr. E. C. Arnold also thinks he saw a Little Bunting. Neither species is rare in Heligoland, the Ortolan being in fact, according to Gätke, quite a common bird on that wonderful island. The north and south direction of the annual lines of migrating Buntings and other small birds on the east coast of England, which are alternately vernal and autumnal, are comprehensible enough, but there are certain other movements of birds in Norfolk during September and October of which the same cannot be said, for they are not to be so easily understood. What I refer to are coast movements, chiefly performed by small birds, and which can only be held to be movements ruled by the wind. These travelling bands of small birds—too much scattered to be called flocks—are especially to be noticed on that part of the coast of this county which lies between Wells and Hunstanton. No doubt it is easier for Sky-Larks, Wheatears, Finches, Yellowhammers, and perhaps an Ortolan, &c., to fly slowly and by short stages against a moderate wind than to remain stationary where they are, and especially must it be easier for Martins and Swallows, which perch but little. But these birds cannot be called migrants in the usually understood sense of the word, because more often than not they are going the wrong way—that is to say, north—at a time of the year (September) when they should be going south.

17th.—N.E., 1; fog in the morning. Mr. E. C. Arnold saw several Sparrow-Hawks and Kestrels near the sea, which had just come in, perhaps delayed by the fog. On the 20th I saw four Sparrow-Hawks† in different places, and about the same time Mr. Lowne had a Sparrow-Hawk and a Kestrel which had been caught on ships. There are always arrivals of these two species in September.

20th.—A Tawny Owl† found drowned in the stable-tank at Northrepps. The reflection of the water may have caused the accident, but I think it more likely that, having just arrived, it went into the first dark corner it saw, with the intention of roosting.

27th.—Two Lesser Spotted Woodpeckers seen at Sustead by Mr. Davy, and one on the 25th at Aldborough. Mr. Dye received a Water-Rail killed by the telegraph-wires in the middle of Yarmouth.

30th.—Saw the first Grey Crow.†

OCTOBER.

1st.—A Hoopoe seen at Drayton (Berners).

2nd.—A young Scaup-Duck,† which fell winged to my shot into a large pond, showed great powers of diving, and it was not until the following day that the keeper retrieved it.

10th.—S.E., 2, with a strong upper current blowing from the west. Flocks of Sky-Larks† coming in from the sea at Overstrand, up to as late as 5 p.m., flying from the north, and they were also noted by Mr. Dye at Yarmouth. It would have been a good day for birds at the light-vessels.

11th.—High wind from S.W. A Swift seen at Sherringham by Sir Digby Pigott, and on the 13th the same, or another, was picked up in Cromer churchyard by Mr. Barclay. Last year the Swift was late in leaving (*cf.* Zool. p. 132), but these laggards are not Norfolk birds, but travellers which have come from some place further north. In 1872 I saw a Swift on Oct. 3rd, and in 1874 one on Oct. 14th—both near Cromer.

12th.—A Skua, probably Richardson's Skua, was seen by Mr. Bird at Wells, mobbing a Heron, which it made to drop its prey, but the Skua did not attempt to secure it.

15th.—A Fork-tailed Petrel picked up at Yarmouth (Saunders).

Snow Geese.†—Towards the end of October, when the Pink-footed Geese were arriving, according to custom, on the grasslands which form their favourite feeding-grounds at Holkam and Burnham, it was seen that there were two white ones among them, and subsequently a third stranger of a dusky lemon tint was detected by Mr. A. Napier, who at once rightly concluded that the white birds were Snow Geese. They were not very shy,

and on several occasions Mr. Napier managed to crawl within a hundred yards, so as to plainly see the black primaries every time they unfolded or raised a wing. I was not so fortunate as he had been, but thanks to his piloting on Dec. 1st we got on that day within a quarter of a mile of the two white ones, and when they rose with the whole flock of some five hundred Pink-footed Geese from the grass on which they had been scattered it was a sight to be remembered. At the beginning of January the Snow Geese were joined by two more anomalous strangers, described as being of a lemon tint in plumage, but up to the time of going to press their identity had not been established. The question is whether these Geese, as well as four Snow Geese, recorded as being recently seen in Ireland (Zool. 1909, p. 77), are wild ones, or whether they have not, as seems probable, flown from Woburn, where the Duchess of Bedford bred a good many, and allowed the young ones to fly unopinioned.

NOVEMBER.

5th.—W.S.W., 2. To-day Rooks, Grey Crows, Jackdaws, Starlings, a flock of one hundred and fifty Wood-Pigeons, Fieldfares, Redwings, and Lapwings—one flock of two hundred—were seen arriving from over the sea by the gardener at Northrepps, in an almost continuous stream from 6.50 a.m., when he went out, to 8.15 a.m., after which the stream slackened, and there were only stragglers. Probably the flight had been going on long before he got up, for the birds which we see by day may not be a thousandth part of what arrive before it is light, when we have little or no cognizance of their flights overhead. It was rather remarkable that three days afterwards, the weather being very fine, Rooks were to be seen near Norwich, with settled purpose going north, but it was against the wind, as was the direction of those arriving in England on the 5th.

[18th.—Lanceolated Warbler shot in Lincolnshire.]

DECEMBER.

1st.—W.S.W., 3. A very late Wheatear seen at Eccles-on-the-Sea by Mr. Bird.* I have not before this had a later date for the Wheatear than Nov. 2nd.

* Another on Jan. 3rd, 1910, at Twyford (C. Hamond).

2nd.—W.N.W., 3. A Glossy Ibis—probably the last survivor of a flock whose deaths were recorded in Yorkshire, Ireland, and elsewhere—shot between the River Bure and Breydon by a cow-keeper (B. Dye). Also Mr. Saunders informs me he had a Little Stint from Breydon, a very late date for it.

31st.—A Bittern heard “booming” by Mr. Bird.

VARIETIES OF PLUMAGE.

On Jan. 8th a cream-coloured Starling was seen by Miss Buxton near Aylsham. On April 21st a brown Partridge of the *Perdix montana* type was watched for some time in a field at Sculthorpe by Mr. Hamond, which did not appear to have a mate; it was near a pair of the ordinary colour. Another was seen at Baudeswell on Dec. 31st (Walter). It has been lately ascertained that this erythrism also occurs in the Grouse ('British Birds,' iii. p. 342). On May 16th a pure white young Hedge Accentor,† which could not have very long left its nest, was caught by a prowling cat at Sprowston. On Sept. 6th Mr. T. E. Gunn received from Diss a white Pied-Wagtail,† immature, just showing a tinge of yellow on the cheeks and crown. At the same time a similar one, probably from the same nest, appeared at Sherringham, where it remained until the 14th, or later. I just missed seeing it by a few hours. On the 13th a pale variety of the male Wheatear† was shot near the sea by Mr. Richards. Almost the only colour which this bird exhibited was a tint of slate-colour on the back and head, which gave a cast of blue to its appearance when fresh. It was mounted by Mr. Pashley, who also had a handsome pied one,† and a pied Brambling,† but the latter was a cage-bird. On Dec. 31st a black-and-white Coot was among the slain at a Coot-battue held on our largest Broad, as I understand from Mr. Nudd, who states that the bag totalled six hundred, and four Pochards.

WOOD-PIGEON DIPHTHERIA.

It does not seem that the disease in Wood-Pigeons resembling diphtheria has by any means died out in Norfolk, for several correspondents mention meeting with victims to it during the winter months, but I did not hear of any being picked up in the summer. One was picked up which had died in the act of

drinking; another was seen by Mr. R. Gurney to quit a tree, and, after circling round once or twice, to fall dead in its flight; others were caught by the hand. No Stock-Doves are reported as being affected, which perhaps favours the theory of the disease having been brought here by migratory Pigeons.

FOOD OF THE BARN-OWL.

Sept. 10th.—On climbing up to a Barn-Owl's roost, where they have bred in a barn of mine for several years, we found a Mole among the customary pellets of mice-fur and bones. It is seldom that Owls eat Moles, and this one had been ejected whole, and only half-digested, as if the Owl had not liked it overmuch. I have never kept any birds of prey, nocturnal or diurnal, which would eat Moles if they could get anything better. Needless to say there was no remains of game. A Norwich gardener, in an essay written a few years ago, says:—"The number of mice a pair of these Owls will destroy is almost incredible. . . . When the birds have young, their visits to their nests are frequent. I have timed them on many occasions, and found their visits averaged eight times per hour. . . ." Yet some of our wooden-headed gamekeepers in Norfolk continue to destroy this useful ally; but farmers know better than to kill them, and no wonder when they get a hundred rats out of a fifty-quarter wheat-stack, and field-mice which do more harm to stacks than rats!

RED GROUSE.

An unsuccessful attempt to rear Grouse was made this summer by a gentleman at Lingwood; of eight young birds five nearly reached adolescence, but just when they had begun to use their wings they dropped off from some cause. A good aviculturist who has reared them says that if they are once allowed access to heather they will neglect all other food for it.

THE NESTING OF THE COMMON TERN AND BLACK-HEADED GULL IN COLCHESTER HARBOUR.

BY THOMAS HEPBURN.

I WAS enabled during the early summer of 1909 to make some extended observations on a mixed colony of Common Terns (*Sterna fluviatilis*) and Black-headed Gulls (*Larus ridibundus*) which were nesting in Colchester Harbour. I will not define the position of the colony more closely.

Although I only located the colony last year (1909), I had previously, in the late summer of 1907, seen a large mob of Common Terns resting on the mud of one of the tidal creeks—at a spot, as it turned out, not far from their nesting site. The composition of the mob, adult birds and the young of the year together, and the large number of individuals forming it, suggested the members of a colony gathered together previous to their autumn migration. During the summer of 1908 I made notes of several individuals of the same species seen in various localities of the estuaries of the Colne and Blackwater. But I could obtain no information locally, either from fishermen or shepherds, of any spot where they nested. This, however, I found myself last spring by a careful and systematic exploration of the creeks and saltings of the neighbourhood in which I saw the big mob in 1907. Even the gentleman to whose farm the land on which the birds nested was attached was not aware of their presence. Through his courtesy I was enabled to pay many visits to the colony, and carry out some detailed observations amongst the nesting birds during the summer of 1909.

Their nesting site was situated entirely outside the marsh walls. It was therefore subject to being submerged by the tide, if ever the level attained was high enough. I have been told that tides occasionally do cover the whole area, but during the months of my observations—May, June, and July—no tide

came anywhere near doing so. There is a prevalent opinion locally that the tides of the spring season are not on the average so high as at other seasons of the year. And they are generally spoken of by the country folk as "bird tides"—the name assuming by implication that the tides are providentially arranged so as to suit the exigencies of the birds sitting on the salt marshes. As will be seen a little later from my notes, the birds sometimes presume too much upon the clemency of the tides towards their nesting operations.

The salt marsh in question might be described as an isosceles triangle in shape, with its base abutting on the upland, and its apex dividing two tidal creeks. The highest ground was on the central and most seaward portion of the triangle. There was a gradual sloping away at each side and at the base near the upland. These lower parts were several times submerged by the spring tides during the three months. But the central tableland—as it might be called—was not. The whole variation between the highest and lowest levels of the marsh would not exceed two feet. The lower margins were deeply intersected by gutters, wide at their mouth, but diminishing as they wound their way inland, until they vanished altogether before the central part of the marsh was reached. These tortuous creeks cut the margin of the triangle into hummocks, in a way characteristic of many salt-marshes, which were covered all over their tops by a thick growth of sea-purslane (*Atriplex*). The higher ground was level and firm; but its surface was broken by shallow basins and narrow channels, with flat bottoms and steep edges, at the most nine inches deep, and three-parts filled with water. This water was of course salt water, and there were plenty of Crabs and Shrimps in some of them, proving that the tide sometimes filled them. The central tableland was thus divided into irregularly shaped areas of flat ground overgrown with fine grass and a great profusion of thrift (*Armeria maritima*) and sea-lavender (*Statice*). The sea-lavender seemed to me to grow most on a slightly lower level of ground than the thrift. It was chiefly on the thrift-bearing ground that the Terns were nesting; that is, on the highest ground of the whole area, and, therefore, the ground least likely to be touched by the tide.

I found the Gulls first of all nesting on the low margins of the triangle, their nests being built amongst the long growth of sea-purslane. But at the very beginning of their efforts at nidification they met with disaster, the tide coming high enough to cover the nests and wash out the eggs. I found these nests on May 11th, one nest already having a full clutch of three eggs, another two eggs; and perhaps a dozen more ready for eggs scattered over the purslane-covered hummocks. On this occasion I saw about half a dozen Terns amongst the Gulls, but could not find any of their nests. Between that date and May 19th a tide had covered this low ground, leaving only a few traces of the more substantially made Gulls' nests, and all the Gulls were scattered. But the Terns were then much more in evidence—to the number of quite a hundred birds; and a careful search all over the higher level of the triangle resulted in the finding of two nests, one containing two eggs, and the other one egg.

My next visit was on May 31st. The Terns had by then made good progress. Fifteen nests were found—three with single eggs, three with clutches of two, and nine with full clutches of three eggs. The Black-headed Gulls were about the marsh, but still showed no signs of nesting.

On June 7th I began a system of marking the nests by means of white wooden pegs—such as are used to label seed patches in a garden—stuck into the ground about a yard off the nest, each peg with a reference number on it. I continued to do this until I stopped my observations, and thus kept a more or less complete record of each nest found. I marked fifteen Terns' nests in this way on June 7th. Between May 31st and June 7th the Gulls had begun to nest, and I marked seven of their nests on that date containing one and two eggs.

I paid weekly visits to the colony after that, with an extra visit now and again, until July 20th. During that time I marked fifty-one Common Terns' nests, and thirty-five Black-headed Gulls' nests. The bulk of the Terns' nests were all marked by June 28th, although I found two nests unmarked as late as July 12th, which might perhaps have been overlooked earlier. The last of the Gulls' nests were marked on July 11th.

The first Terns' nests were hatched on June 14th; and from then on a certain number hatched off weekly, approximately in the order in which I had numbered them, until on July 20th there were only two of their nests left unhatched, the two marked on July 12th. On July 5th several Gulls' nests were either hatched or hatching. On July 20th there were still six of them unhatched.

My visits, with intervals of a week between them, were too far apart to enable the period of incubation to be fixed accurately. The only thing that can be said is that in neither bird did the period exceed twenty-eight days. The observations pointed rather to the period of close sitting being twenty or twenty-one days after the complete clutch had been laid. In the case of the Black-headed Gulls, in half a dozen instances the period from the first egg of a clutch of three to the chipping of the eggs came within twenty-eight days.

Out of the fifty-one Terns' nests, there were thirty-six clutches of three eggs, and fifteen clutches of two eggs. Out of the thirty-five Gulls' nests, twenty-five had clutches of three eggs, and nine had clutches of two eggs; while two nests had a single egg, which eventually turned out to be addled.

The nests of both species were scattered over a considerable area of ground; those of the Terns being distributed in a series of loosely connected clumps. That is to say, you would find half a dozen Terns' nests, with ten to fifteen feet separating them; then a single nest, here and there, at quite distant intervals; then another small collection quite close together. The Gulls' nests were in and out amongst those of the Terns, sometimes quite close to them and to those of their own species; but for the most part widely separated, and the bulk of them forming a fringe round the outside of the area chiefly affected by the Terns. The whole of the nesting site occupied by the two species spread out to a length of a mile and a half, by a width of half a mile.

The greater number of the Terns' nests were made amongst the fine grass and thrift. They were open nests, that is, without any long vegetation overhanging their margins—with the exception of two which were built in some tufts of purslane with the stems overhanging the eggs, so much so as to suggest a Red-

shank's nest. The grass surrounding their nests always became discoloured and withered, as sitting progressed, from contact with the bird. Although there were a few nests with absolutely no lining, the eggs being laid and incubated and hatched in a slight depression of the ground and grass, the rule was a substantial pad of fine grass, plucked green, but drying afterwards, with an occasional substratum of purslane stems and thrift stems. Exceptionally, purslane leaves were added on the top. I took the material out of many of the nests after they were hatched off, and it generally made a big double handful of dry vegetable matter. This lining was accumulated gradually by the sitting bird. In the majority of cases my notes record a "slight" lining on the first finding of the nest; and a "thick" lining, or a "big pad," on the visit a week later. This was particularly noticeable after one wet week, when I found a number of nests made up with fresh material on the top of the old.

The Gulls chose spots for nesting as a rule amongst rather long vegetation, either grass or purslane, which would admit of a good-sized hollow being formed, in which the usual bulky nest of stick and straw foundation could be built, finished off by a well-formed cup, lined with finer materials. A variant on this type was often built on bare ground, the foundation of bulky material raising the cup several inches off the ground. The building of the Gulls' nests seemed to be completed before the first egg was laid.

The nests of both species were used after the eggs were hatched, either by the nestlings squatting in them, or possibly by the parent bird brooding over its young, the nests becoming spattered all round with limy excrement. The Gulls' nests had also distinct "pads" over their margins where the young birds had been going in and out. In several instances there were two of these pads to a nest, and then always opposite each other.

There were a few abnormally coloured Tern's eggs in the colony. In one clutch of two the ground colour was a pale green with olive markings. The bird to which these eggs belonged had lined its nest with fresh green purslane leaves, and the green ground colour of the eggs corresponded exactly in

shade with the colour of the purslane. I looked upon this as a coincidence only, and mention it simply to show how green the eggs were. Another clutch of two eggs contained one of a normal colour, the other a deep red resembling a handsome type of Kestrel's egg.

The nestling Terns, when just hatched, had the feet and the base of the bill pale pink; the tip of the bill was black, with a very pronounced white egg-tooth. The down on the upper part of the body was a pale sandy colour with black stipplings. On the under parts it was pure white, with the exception of the chin and upper throat, which were quite black. As the chicks grew, this black turned to brown and gradually diminished in area. The down of the nestling Gulls was a much deeper shade of colour than that of the Terns. Their bills and feet were dull flesh colour, with a tinge of purple in it—something the colour of hands "blue with cold."

Some of the nestling Terns died. I made notes of sixteen deaths. The rain was responsible for a good many of them. But more than half of the number came to their death by drowning in the shallow pools with steep edges, which I mentioned in the beginning of this article. The water in these pools generally only reached to within six inches of the top of the bank. The nestlings having got into the water were unable to get out over the steep six inches of bank. It looked quite eerie to see a dead nestling Tern moving in jerky fashion across a pool, until the mystery was explained by the discovery of a Crab tugging at it. The nestling Gulls were more fortunate. I marked a number of the nestlings of both species with the aluminium rings issued by the proprietors of 'British Birds.' Only one of the dead nestling Terns had a ring on. But the only nestling Gull found dead was a marked bird, and the ring had caused its death by becoming entangled with the materials of the nest. Some young Shelducks came to grief amongst the Gulls and Terns. Possibly their striking piebald down drew too much attention to their presence. Four of them were lying dead scattered through the colony on July 19th. Two Red-shanks brought off their families successfully during the time I was carrying out my observations, with their nests in close proximity to those of some Terns.

It was not possible to carry out any close observations of the old birds at their nests without risk of keeping them off their eggs too long. The approach for a considerable distance over the bare salting was a sufficient warning to them. At a distance of nearly a mile from the actual nests individual birds would already be screaming over one's head. The Terns were generally the first to arrive, but the Gulls would not be far behind. At the distance of half a mile the sitting birds could be seen rising. By the time I had worked my way through the colony to the far end, the birds would have begun to settle again where I first came amongst them. Watching through glasses from the distant upland, with the sunshine striking on the white plumage of the birds, it was easy to see that, even with no human being to alarm them, they were a very restless community. There was a continual coming and going of non-sitting birds; and it seemed not a little quarrelling amongst those sitting on the eggs.

One could not but be struck by the profusion of the one or two species of flowering marsh-plants which grew on this salting. The thrift was just beginning to open out when I started marking the nests on June 7th. During the weeks that followed there were acres pink with it. By July 4th the flowers were past their prime. Then the sea-lavender was beginning to open; and that would last well towards the end of August, and tint just as large an area of the marsh with its purple.

HAVOC WROUGHT BY THE STARLING (*STURNUS VULGARIS*).

BY J. E. H. KELSO, M.D., M.B.O.U.

PRIOR to Dec. 20th, 1898, I always considered the Starling not only harmless but useful to agriculture. However, on that date a farmer told me he had a suspicion they were eating his wheat. I shot a few, and found he was correct. On dissection I discovered not a grain or two, which might have accidentally been picked up with animal matter, but each Starling had a number of grains inside. A year or two before this I found Starlings would eat grain which had been scattered about to feed Pheasants, also when shed on stubble, but was not aware they would dig up and eat newly sown and sprouting wheat. In December, 1899, I began to thoroughly investigate the matter, and shot Starlings on wheat-fields, finding they always contained grain. This wheat-eating (at least to any extent) appeared to me a newly acquired habit, so I wrote an account of it to 'The Field,' and received several replies, apparently from practical farmers. I quote three:—

1st. "On only one occasion I have found hard wheat in a Starling, and that was in a very hard winter when the threshing machine stood in the rickyard (it had been threshing wheat), and there came a deep snow. After a day or two I swept a path to shoot Sparrows, and shot, amongst others, a Starling; it had several grains of wheat inside, but birds would be hard pressed for food, so it was not much to go by."—WHIPCORD.

2nd. ERNEST D. RIDER, Edgebolton, Shrewsbury, stated "that Starlings did a great amount of damage to the wheat on his farm, and that of his neighbours, the previous autumn by stocking up and eating the wheat just as the shoots were coming through the ground. Although he had always protected the Starling for the amount of good it did, on this occasion he was compelled to shoot at them for two days before they would leave the field

alone. He opened many, and found wheat in them all, and the field was covered with holes where the Starlings had been pecking down to get at the grain. The only other instance of the kind he knew was about ten years before during a sharp frost in autumn."

3rd. Mr. LENO COX, Pond Farm, Hemel Hempstead, stated "he farmed between five and six hundred acres of land, and in his experience the Starling had been occasionally one of severe loss. Whenever he had wheat sown rather late the Starling had done a vast amount of damage, but the wheat that had been sown in good time they had never meddled with. The mischief, he contended, is done just as the blade is showing itself. The Starling then makes a hole down the side of the blade, and squeezes the pulp out of the seed. A few years before one of his outlying fields had been completely ruined by Starlings, and had to be ploughed and sown again in spring."

In 1905 correspondence again started in 'The Field' *re* damage done by Starlings. I should like to state here all my observations were confined to Hayling Island, Hants.

Before December, 1898, I found Starlings fed on molluscs, worms, wireworms, leather-jackets, cockchafer-grubs, ticks, beetles, spiders, and occasionally fruit, such as raspberries, figs, cherries, sometimes pears. Since 1898, every year I find Starlings shot on wheat-fields—from the beginning of November to about the middle of January, according to the season—contain much wheat, but even during this time, when shot on meadows or stubble, they contain insects and their larvæ, also molluscs.

On Hayling a few Starlings begin to eat the wheat immediately it is sown; on the second day they appear in greater numbers, and continue at frequent intervals to devour the grain till the blade is just sprouting above the ground, then they leave off. Contrary to the experience of one of the correspondents in 'The Field,' I find even when the wheat is sprouting they swallow the whole grain, not the pulp alone. In frosty or very wet weather they cease to attack the crop; in the former case because they cannot reach it, in the latter probably from two reasons—1st, their insect-food is found more easily; 2nd, the semi-liquid earth clogs their claws and impedes flight.

STOMACH CONTENTS OF STARLINGS.

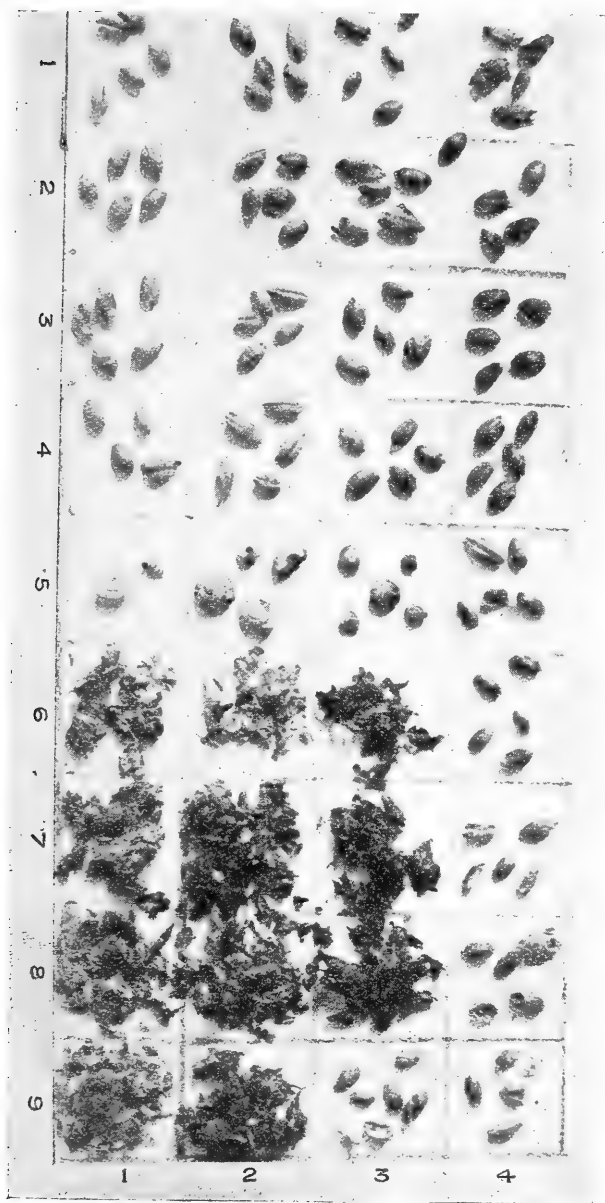
Nov. 14th, 1909, a field of wheat was sown; Nov. 16th it was visited by a flock of between two and three hundred Starlings, which busily commenced feeding. A shot fired into them accounted for seven. One of these contained 37 grains of wheat (I think this amount excessive), one shell of *Helicella caperata*, one shell of *Paludestrina ventrosa*, a triturated mass which appeared to consist almost entirely of wheat; this mass weighed 46 grains, the separate grains of wheat, 32 grains; total weight of contents in one stomach, 78 grains.

Of the whole seven Starlings, the contents were 112 separate grains of wheat; excluding the two small molluscs in the first Starling mentioned, the rest contained four shells of *Hygromia hispida*, five shells of *Helicella caperata*, one shell of *Cochlicopa lubrica*, a few small beetles and elytra, and a mass of triturated material apparently almost entirely wheat. This triturated mass, the few molluscs and beetles, weighed 112 grains, the separate wheat-grains, 95 grains; total, 207 grains. The 112 grains, or rather separate grains of wheat, consumed by the seven Starlings give an average of sixteen grains apiece, but this takes no account of the large amount in the triturated material found, which amount, I believe, represents far more wheat than the 112 separate grains.

Sown wheat lies at an average depth of one and a half to two inches, but the Starling finds no difficulty in reaching it so long as there is no frost.

Dec. 29th, a single Starling, shot among Sparrows on a barley-stubble, contained fourteen barley- and three wheat-grains, a shell of *Helicella caperata*, four leather-jackets, and three red ants; also five seeds of a weed, either dock or plantain. This wheat-eating on the part of the Starling may be accounted for by its vastly increased numbers of late years. On Hayling since 1898 the Starling has increased enormously. Strange to relate, these birds rarely attack oats or barley. However, taking the whole year round, the Starling does more good than harm, I believe; but will this continue if he increases at the rate he is doing at present?

When studying the food of birds, one must take into consideration that the trituration of animal matter will be a



Newly-sown wheat, molluscs, and tritured material contained in the stomachs of seven Starlings.

speedier operation than is the case with cereals, and that as digestion and absorption of the former, in the majority of cases, takes place so much quicker in comparison, we must expect to find insect remains, which can be identified only very shortly after being swallowed.

In 'Nature Notes,' May, 1905, a writer, under the heading "Starlings in Australia," refers to the destruction of fruit caused by the Starling in the Antipodes. These birds were the descendants of British imported ones, and he goes on to say that he hopes the Starling's character will not suffer in consequence in this country. I replied in the following number, pointing to the damage done on Hayling. An extract from his reply (*vide* "Starlings, are they Friends or Foes?") was as follows:—"The amount of grain eaten by the Starling is very small, and it could hardly be called granivorous."

Of course the Starling cannot be called "granivorous," but I again want to emphasize the fact that this wheat-eating propensity must have begun in recent years. One correspondent, in replying to my notes in 'The Field,' incidentally remarked that Sky-Larks had ruined an eight-acre field of wheat. On only one occasion have I found them doing damage, when in the stomachs of two Larks shot near some offending Starlings wheat was found; they had not swallowed the grain, only the pulp.

In the Supplement to the 'Journal' of the Board of Agriculture, vol. xv., Dec. 9th, 1908, the food of the Starling is somewhat exhaustively gone into on page 57. It is reported to eat, in Cheshire, beetles, molluscs, larvæ of moths, pupæ, flies, wireworms, "daddy-longlegs," their larvæ, worms, bread, grass.

The following extracts refer to the few instances in which cereals were found in the stomach contents:—

August, 1893, one immature female contained a few grains of wheat. A male, Sept. 8th, 1903, two grains of undressed wheat. Oct. 30th, 1900, many oat-glumes (? from horse-droppings). Nov. 25th, 1904, two males (3, 9, 5 and 3, 9, 6)—both examples filled with equal proportions of vegetable matter and insects; the former consisted of wheat, oats, glumes, and one complete grain of the oat. November, 1904 (? sex), two grains of wheat.

The summary of the article states the result of the investigations, *viz.*: eleven contained insects of the injurious group; five, beneficial group; seven, indifferent group; five, wheat; two, oats; four, molluscs; five, grass.

Damaging young wheat crop: The two examples (Nos. 3, 9, 5, 3, 9, 6) were forwarded with the note that they were shot while in the act of damaging a young wheat-field, but no trace of the young plants was found among the stomach contents; so that it is highly probable that the birds had pulled up the plant in order to reach the maggots or fly-larvæ which they were found to contain.

On Hayling, of late years, they presumably devour wheat as a food itself, not for any larvæ or maggots contained in it.

Mr. Beeston, of Havant, very kindly identified the molluscs contained in the Starlings I shot.

The photograph I took shows the newly-sown wheat, molluscs, and triturated material contained in the seven Starlings. Before the photograph was taken of the 112 grains of wheat two were lost, and of the molluscs the one shell of *Cochlicopa lubrica*.

A LOST BRITISH BIRD.

BY FREDERICK J. STUBBS.

DURING the Middle Ages England was the home of a White Heron or Egret, of which no useful description appears to have been handed down. Several of the earlier ornithologists referred vaguely to it, but an unfortunate note by Dr. Fleming in 1828 seems to have driven the bird out of the thoughts of modern students of the British avifauna. The following notes (which in no way exhaust the subject), if not sufficient to reinstate the species in natural history, may perhaps stimulate some other student to turn his labours to the same end.

The tiresome, but in this case necessary, task of reviewing the works of certain old ornithologists must be attended to first. William Turner (1500–1568), in his '*Avium Præcipuarum*,' &c. (A. H. Evan's edition), after noticing the Common Heron, goes on to say that there was another, the "Alba, which was fair in colour, . . . and brings forth young well." On the same bird he remarks: "Of this [the Common Heron] I have seen some white, though they are rare, which differed from the aforesaid in colour only. Furthermore, the white has been observed in England to nest with the blue, and to bear offspring. Wherefore it is clear that they are of the same species." Subsequent writers (Merrett, Muffett,* and Tunstall) mention a White Heron, but the remarks of Francis Willughby are important, and need to be given in full. I quote from Ray's edition of the "*Ornithology*" (1678, p. 279):—

"The Great White Heron, *Ardea alba major*. This differs from the Common Heron, 1 in magnitude, as being lesser than that. 2 in the length of the tail. 3 in that it wants a crest. A certain Englishman (saith Aldrovand) affirmed that he had seen white Herons, though rarely, which neither in bigness of body nor shape differed from the common Heron, but only in colour. I suspect this Relator, whoever he was, was mistaken, accounting the bird in this article described by us as not to differ from

* '*Health's Improvement*' (1655). The following passage (p. 93) cannot be known to a critic of Merrett's ('*British Birds*,' ii. p. 161):—"All the Heronshaws (namely, the Black, white, criel-heronshaw, and the mire dromble) though feeding somewhat better than the Byttor or Stork," &c.; and Muffett mentions the Spoonbill as "Shovelard."

the common Heronshaw but only in colour. For Mr. Johnson,* who hath seen the bird in England, puts it down for a distinct kind in his *Method of Birds* communicated to us." This correspondent of Aldrovand was, as we now know, William Turner. I desire to lay stress on the point that there was some doubt whether or not this White Heron had a crest, but more will be said later on this. That Willughby himself had no knowledge of the bird is a matter of little importance, for he can only speak of the Crane from hearsay; yet the abundance of this species in England in former times is beyond question. And Tunstall classed together in an appendix of '*Aves raro in Britanniam adventientes*' Crane, Egrette, Great White Heron, Spoon-bill, Crossbill, and even Brambling. It is also necessary to quote the remarks of Pennant ('*British Zoology*,' 2nd ed. vol. ii.). Under the heading of Great White Heron (p. 345), after referring to Willughby and Turner, he speaks of the "Egrittes" of Leland as a smaller but crested bird; and at p. 495 he prints the bill of fare for the great feast at Cawood, in Yorkshire, on the enthronization of Archbishop Neville in 1374 (*cf.* John Leland's '*Britt. Collectanea*,' vol. vi. pp. 2 *et seq.*). At this feast vast quantities of game and other animals and birds were consumed. There is no need to go into all the details of the hundreds of Cranes, Bitterns, Herons, &c., that appeared at this orgy, and only one item may be mentioned. It is "Egrittes, 1000." Leland's figures, large as they are, were accepted by Pennant, who was certainly not ignorant of the minor details of English history.

We now come to the time of Fleming's unlucky comment. In 1828, in a '*History of British Animals*,' he has the following passage (p. 96):—" *Ardea garzetta*, Temm. This is supposed to be the species, a thousand individuals of which were served up under the name Egrittes at the feast of Neville in the reign of Edward IV. It is possible, however, that the Lapwing may have been referred to, as the commonest bird with a crest. On the supposition that this Heron was the bird alluded to, it will be difficult to account for the silence of Willughby and Ray in regard to this species being a native of Britain." As we have seen, Willughby believed in a British species of White Heron, but was not able to prove that it had, or had not, a crest—that it

* Johnson was a Yorkshireman, rather an interesting fact in connection with Leland's account of the Cawood Feast.

was *Ardea alba* or *A. garzetta*. But the mischief was done. Selby agreed with Fleming, and, later, Yarrell agreed with both these writers, like them without making any independent enquiry, and in his well-known work he dismisses the subject as follows:—

“The oft-quoted passage from Pennant . . . is probably founded on error. As suggested by Fleming, and followed by Selby, the birds were no doubt Lapwings.” Yarrell’s opinion, although it was founded on Fleming’s hasty and dogmatic passage, is shared by every ornithologist of the present day; a footnote on p. 505 of Newton’s ‘Dictionary of Birds’ summed up one other aspect of the matter, but here the errors of a few are used to condemn the writings of a correct many.

From works other than those of professed naturalists I have succeeded in gathering a great deal of evidence showing that about the time of Neville’s feast the Egret was both common and well known in England. Only a portion of the evidence can be given here. In one of the MSS. of the Harleian Library (Douce MS. 55 (date 1430), cf. Austin, Eng. Text Soc. p. 115) will be found directions for killing, cooking, and carving the Egret: “Egrett Rost. Breke an egrettes nekke, or cut the rofe of hys mouthe, as of a crane . . . folde his legs as a bitore [Bittern] . . . & rost hym.” A Crane was killed by cutting the roof of the mouth and “lete him blede to deth.” Another Harleian MS. (4016, date 1450) refers to this method of slaughter, which was used on Curlews, Swans, Herons, and Bitterns: “Kutte in the rove of the mouthe toward the brayne enlonge.” John Russell, in his ‘Boke of Nurture’ (written 1460–70, printed 1867, E. E. T. Soc.), mentions the Egret several times. He tells how in “Wodecok, Bitoure, Egret, Snyte, Curlew, and Heyronsew” the beaks must be broken by the carver, thus suggesting that all were long and breakable. But he does not mention this operation in speaking immediately afterwards of the “Feysaunt, Partriche, Plouer, and Lapewynk.” And, again (line 539), the Egret is classed for another reason with Heyronsewe and Crane, while a few lines below he speaks of “Bustard, Betowre, Shovelar [Spoonbill], Wodecok, and Lapewynk.” Newton cannot have been aware of this and several other works when he stated that the Egret of the Middle Ages was nothing but the Lapwing.

In 1508, and again in 1513,* Wynkyn de Worde, the famous printer, published an anonymous 'Boke on Kervynge.' Here again occurs "Plouer or Lapwyng," followed almost immediately by "Bytture, Egryt, and Heronsewe." In those days they must have been punctilious in their terminology (as people are even now in some forms of sport), and some of the appropriate verbs are very curious. For instance, one had not to use the word "carve" at all. The actual term depended on the bird: "Dysplaye a Crane"; "Dysmembre a Heron"; "Vnoint a Bytture"; "Breke an Egret"; "Mynce a Plouer," &c.

It is worth noting, in de Worde's volume, that an Egret has to be carved as a Heron, while a Plover must be carved as a hen. In the "dysplaying" of a Crane the novice is warned to "beware of the trompe in her breast," thus showing an acquaintance with the remarkable coiled trachea present in no other British bird. Indeed, all through these old books one detects the experience and knowledge of the writers, and this knowledge appears also in other books besides those relating to sport or the table. Cotgrave, in his 'Dictionary' (1611), translates the French "Aigrette" to "a fowl like a Heron, but white; a criell or dwarf Heron." And one Peter Lewin, in a curious 'Rhyming Dictionary,' first published in 1570, translates Egret to the Latin *Asterias* [= Heron or Egret]; and there are many other references which, although carrying individually but little weight, afford strong proof that the Egret was well known as a sort of Heron to the writers of the fifteenth to the seventeenth centuries.

One other work mentioning the Egret must not be passed unnoticed, for it is of extraordinary interest to ornithologists, although to-day practically unknown; I have never seen it referred to in any book on birds. It is a MS. containing elaborate directions for the proper government of a nobleman's house; it is dated 1605, and was published in full by Sir Joseph Banks in 'Archeologia,' vol. xiii. pp. 315 *et seq.* This paper includes unusually copious lists of game-birds and wildfowl in their proper seasons. The Bustard is mentioned, and also the Storek, Crayne, Shoveler, Ruffe, and Bittor. The Lapwing appears

* There was, I find, another edition of this rare work printed by E. Alde (1590?). The word is here spelled "Egript."

as "Lapwine."* The bird now particularly under notice is here mentioned under several different spellings—Egrett, Egrete, and Egreate. It was in season in April and May, so there is no wonder it became extinct. The reader will easily understand that the author of this old MS. did not mean "Lapwing" when he wrote "Egret," for both the birds were known to him, and both are specified. I have not yet found the locality for this nobleman's house, but, judging from the list of birds available for food, it was on the coast, and towards the north—very possibly Northumberland, Durham, or Yorkshire. Some of the old names are rather curious—Pevette [Black-headed Gull], Jed-cocke [Jack-Snipe], Cudberduce [Eider], Cullver [Pigeon], Elke [Wild Swan], Crouces [Grouse], and Curlewiacke [Whimbrel]. This MS., like so many others of the period, mentions the "Brewē." I have been unable to find out what bird this is. Dr. Furnivall ('Meals and Manners,' E.E.T.S. p. 27) suggested the Whimbrel, but there are two objections—the bird is in season at the wrong time, and in the Banks MS. the Whimbrel is actually mentioned as "Curlew Jack," still a frequent name in the North of England. Perhaps I may make the suggestion Glossy Ibis, or more probably one of the Godwits. I am also in the dark as to the meaning of the name "Bayninges." Were they water birds addicted to plunging? Here occur the common items "Grete Byrdes," and also the less usual "Smale Byrdes." The former could not have been very "great," for in the 'Percy Household' Book they are priced at "iiij a pennye," Larks being "xij a pennye," and Herons and Bitterns a shilling a piece "so they be good." Strange to say, in the 'Percy Book,' the price of Sholardis [Spoonbills] was only half that of Herons.

It has been suggested to me that these old books may have been translations of earlier French, Italian, or German works on manners or cookery, and so must not be accepted as indices to the bird-life of England. I might as well add that I have been carefully through all their lists of birds, mammals, and fishes, and find no species that are common on the Continent and unknown here, with the exception of the Egret—and this I

* Professor Skeat has shown that the second syllable in the modern word has nothing to do with *wing*; the whole name is from the Anglo-Saxon "Hleapewince"—one who staggers or turns in flight.

claim to have been a common English bird at the time.* It is perfectly clear that this special literature was based on a British fauna, the constituents of which were familiar to the various writers. Fortunately we have even stronger evidence than that provided by the cookery books, dictionaries, and works on sport. The account of the Egrets at Neville's famous feast is still under a cloud, and it need not be used again.

But at the Coronation Feast of Henry IV. at Westminster, Oct. 13th, 1399 (Harl. MS. 279 and 4016) we read that "Cranye, Byttures, and Egretez" were served during the second and third courses. Thirty-six years later, at a feast on the occasion of the induction of Stafford to the Bishopric of Bath and Wells (Sept. 16th, 1425), "Egrets" were served, as were "Heyroun, Crane, Curlewe, Pety Curlewe, Plovers, Snytys, Gullys, Tele, Fesauntes," &c., and "*Hyrchouns*" [Hedgehogs].

Lapwings, by that name (they were spoken of at times as "Lapewynk" or "Plouer"), are not of frequent occurrence in these old bills of fare. They may have been recorded as Plover, but the present writer has elsewhere ('Naturalist,' 1907, pp. 310-11) given his reasons for believing that the Lapwing has not always been a common bird in England, but has increased with man. If it was, as Newton and others suggested, that "Egret" was the old English name for Lapwing, how is it that so few *thoroughly reliable* proofs of the mistake have reached us to-day? The modern error is based on the obvious mistakes of one or two theological writers of the Middle Ages; for all we know to the contrary, the Lapwing was so rare to their minds that they were unacquainted with its edible qualities, and so made the "*vpupa*"† and "*Egettides*" mistakes referred to by Newton. There is not the slightest room for doubt, after comparing the directions for killing, cooking, and carving the various birds, that the "Egret," whatever it was, had much the same shape, size, and structure as the Bittern and Heron, while the Lapwing was much like a Plover or Partridge. The comparative numbers served up provide us with no clue, for at a feast to King Richard in 1387, on Sept. 23rd, although fifty Swans, two

* John Russell speaks of the Beaver, and how its tail had to be served with green peas, but this interesting animal can be left for some future discussion, and the same remark can apply to the Stork.

† Lewin (*t. c.*) translates "Lapwing" "*vpupa*," but he made no mistake about "Egret."

hundred Geese, one hundred and twenty Curlews, one hundred and forty-four "Brewes," twelve Cranes, and "Wilde fowle ynogh" were provided, they could only get four "Fesauntes" and five "Hérons and Bitores." So far as the wild birds are concerned, these figures would be different at the present day. From the fact that the cook had to kill the Egrets, Cranes, Herons, and Bitterns, and in some cases save the blood for making a sauce, it would appear that these birds were caught alive and kept till required. This view is supported by the Act quoted below.

The netting and snaring of Herons and other birds was, even in 1503, a menace to the stock, and in that year a law was made (19 Hen. VII. cc. 10, 11) forbidding the netting or trapping or the killing of Herons except by hawk or longbow, under a penalty of 6s. 8d. What effect this Act had I cannot tell, but shortly afterwards the native birds *and their eggs* had been systematically harried "in such wyse that the brode of wyldefouille is almost therby wasted and consumed and dayly is lyke more and more to wast and consume yf remedy be not therfore pydyed," &c. (25 Hen. VIII. c. 11). This wise law protected the eggs of Crane, Bustard, Bittern, Heron, Mallard, and other fowl; the Egret is not mentioned, but it is by no means the only omission. This Act contains the admission that formerly "the King's Household and the houses of Noblemen and *Prelates* [!] have been furnished at reasonable prices, but now the birds are almost extinct."

Unfortunately, an agitation ostensibly in favour of the wild-fowlers led to a new Act (3 Ed. VI. c. 7) repealing or modifying previous laws, and from this year we must date the beginning of the end for many a British bird. The Egret, as we are told by those who have studied it in its southern home, is peculiarly unsuspicious of mankind, and there is no doubt it would be one of the very first to disappear. I do not hesitate in thinking that the bird was *Ardea garzetta*, and not *A. alba*. We do not know enough to assume that it was an insular species with no living representatives. A very few chance occurrences already give us the privilege of adding the bird to our list, but I hope the foregoing remarks will help to place it on a more dignified footing as a British bird, "once very common, but now, owing to persecution, quite extinct in England." Perhaps further study may settle the actual species, for to quote Chaucer—and on birds too: "Out of olde bokes in good eith cometh al this newe science that men lere."

NOTES AND QUERIES.

MAMMALIA.

Notes on the Mammals of Islay.—Mr. Harold Russell is quite right in that the late Mr. T. E. Buckley and I were “incorrect” in stating that “the Lesser Shrew is the species which alone inhabits the Isles.” We now realize, what Mr. Russell tells us, that *Sorex araneus* has been identified by Mr. Oldfield Thomas as occurring in Islay. We ought to have said “up to the date of our writing (*i. e.* May, 1892), *Sorex minutus*, which alone *had been found* inhabiting the Isles,” &c. This, I think, would have more correctly described what was then known of the distribution of this land mammal. We find that the late Mr. Edward R. Alston, when he wrote his “Mammalia” for the ‘Fauna of Scotland,’ prepared for the Glasgow Nat. Hist. Soc.—and which we very fully quote in our volume on the ‘Outer Hebrides’ (pp. 1–7)—he at that time *queried* the occurrence of either *S. tetragonurus* or *S. minutus* in the Isles of the Inner Group of the Hebrides, but recorded the presence of *S. minutus* both on the Mainland and in the Outer Hebrides—and, indeed, founded two arguments on the Natural Dispersal of Land Mammals in Great Britain—and, as regards Ireland and Scotland especially, upon that and similar phenomena. As the Common Shrew has only *now* been identified and recorded from Islay, there still seems to be some difficulty in accounting for its *natural* occurrence there, if we accept Alston’s views of Dispersal.

As I am writing just now, I may mention also that a white Otter (*ante*, p. 114) was preserved by the late Mr. Henry Evans, of Jura, where I saw it in the hall of his Shooting Lodge at Small Isles, Jura. It had been captured in Jura. — J. A. HARVIE-BROWN (Dunipace, Larbert, Stirlingshire, N.B.).

P.S.—I would like to add that I hope *all* that was written so long ago as 1888 and 1892 will not be considered as applicable to the state of a changing fauna and the changed conditions of the present time, knowing as we do how *rapid* are many changes in dispersal and extension of species from numerous causes which may not have existed a short twenty-five years ago.

Variety of the Mole. — On March 25th last I trapped in this garden a male Mole weighing a little over $3\frac{3}{4}$ oz., and in very good condition. It had a patch on the throat, a small patch on the forehead, and a large one on the lower belly of the orange-chestnut sometimes seen much more largely developed on the under parts.

The colour in this specimen was dull and dusky, and not the brilliant shade we see in some examples, that on the throat being the lightest and brightest. There was an obscure shade, or cast, of brown all over the upper parts, but affecting only the outer surface of the fur. I have never before met with the orange-bellied variety of the Mole in this district. The buff or apricot variety has occurred several times in Oxon, and a Mole-catcher told me he once caught one with a white mark as big as a horse-bean on its head.—O. V. APLIN (Bloxham, Oxon).

Lesser Shrew in Bedfordshire.—The first record of the Lesser Shrew (*Sorex minutus*) being obtained in the county of Bedfordshire applies to a specimen taken at Blunham on March 7th last. A tenant of mine at the Old Mill House caught one in his pantry in a mouse-trap baited with a raisin. Fortunately the specimen was sent on to me with a request for the name of the “wee beastie.”—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

AVES.

Late Departure of Chiffchaff.—On Jan. 13th last I saw and watched for some minutes a Chiffchaff (*Phylloscopus rufus*) at Buxted, Sussex; it was hopping about the sides of a stable-drain, and taking the insects on the wing as they arose. I supposed this bird to have been a late departure rather than an early arrival.—ROBERT MORRIS (Uckfield, Sussex).

Chiffchaff in Hants.—I here heard and watched for some time a Chiffchaff on March 15th. It was busy “chiffing” about some tall hazel and young ash.—T. A. COTTON (The Mount, Bishopstoke, Hants).

Nesting of the Wren (*Troglodytes parvulus*).—Last year some instances of—to me—an unusual choice of a nesting-site for this bird came under my observation in this district. I refer to nests built in holes in trees and walls; by holes I do not mean open places in walls, &c., caused by the removal of a half brick or stone—Wrens often choose such a position—but small cavities such as might be occupied by hole-breeding birds, and where in the case of the Wren the domed nest is necessarily dispensed with. One nest was formed in a small hole in an ash-tree, the cavity was lined with moss throughout, the entrance to the hole being built up from the inside with moss closing up the aperture in the bark with the exception of the usual small hole for access; this was the only portion of the nest visible, and there was no attempt at a dome or hood to the entrance hole. Another nest was constructed in the top of a hollow tree-stump serving as a gate-post. The hollow was more or less open at

the top, so a dome was partly formed in this case. The entrance to the cavity was a narrow vertical slit at the side; this was partly filled up with moss from the inside as in the other instance. The nest contained half-fledged young. In both these cases the contents of the nest could not be reached by the hand, owing to the smallness of the aperture and depth of the nest. Very little of the nesting materials was in view, the nest being practically built inside the hole. More curious still was a nest I saw in Denbighshire in June, 1908. It was built in a hole in a bare slate-built garden-wall overhung by thick laurel-trees, and consequently in a very dark position. The front of the nest, which was not domed owing to the confined space, was set back six or seven inches from the face of the wall so that no part of the nest was showing outside; the fact of the old birds carrying food to the young betrayed the nest. Here again the hole in the wall—a horizontal slit—was too small to insert the hand. I may add that last year a Wren built in a hedge in my garden. The nest was completed with the exception of the lining on March 20th, and then apparently deserted; on June 7th, when I chanced to look at the nest, the bird flew out, and it contained a full clutch of fresh eggs. Mr. J. Steele Elliott records a somewhat similar case in 'The Zoologist' for 1905 (p. 141). As regards the habit of building super-numerary nests, I do not believe that it is so universal as is generally supposed, though it is undoubtedly of frequent occurrence. It may be that the habit can be accounted for as being more an outlet for superabundant energy—as is the case with some of the Weaver-birds—than as serving any utilitarian purpose.—S. G. CUMMINGS (Upton, Chester).

Swan Marks.—It may be useful to call attention to "S'enssieult les privilèges, ordonnances et statuts que les seigneurs ont sur la rivière de Scarpe, pour visiter et marquer les eignes des marques desdits seigneurs." This paper, dated Aug. 18th, 1547, is illustrated with ten figures of Swans, under each of which the mark on the bill is described in full. It is preserved in the Archives de Flines, is printed with other documents on pp. 318-322 of 'Mémoires de la Société Nationale des Sciences, de l'Agriculture et des Arts de Lille,' Année 1850 (1851), under the title, "Nouveaux Analectes ou Documents inédits . . .," by M. le Glay, and is thus completely buried and lost sight of to those interested in Swan-nicks.—C. DAVIES SHERBORN.

Reeve in Gloucestershire.—On Sept. 1st, 1909, a Reeve (*Machetes pugnax*) was shot by Mr. Cook near Tetbury, about half a mile from

the Wiltshire border. I have been informed, on very good authority, that two Snow Geese (*Chen hyperboreus*) were observed last January for a fortnight or more on the Holkham estate. Both birds escaped, although repeated efforts were made to shoot them. — COLLINGWOOD INGRAM (The Close, Tetbury, Glos.).

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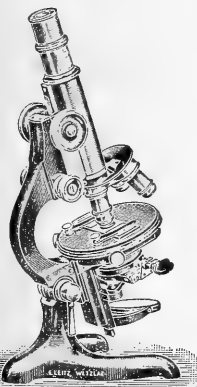
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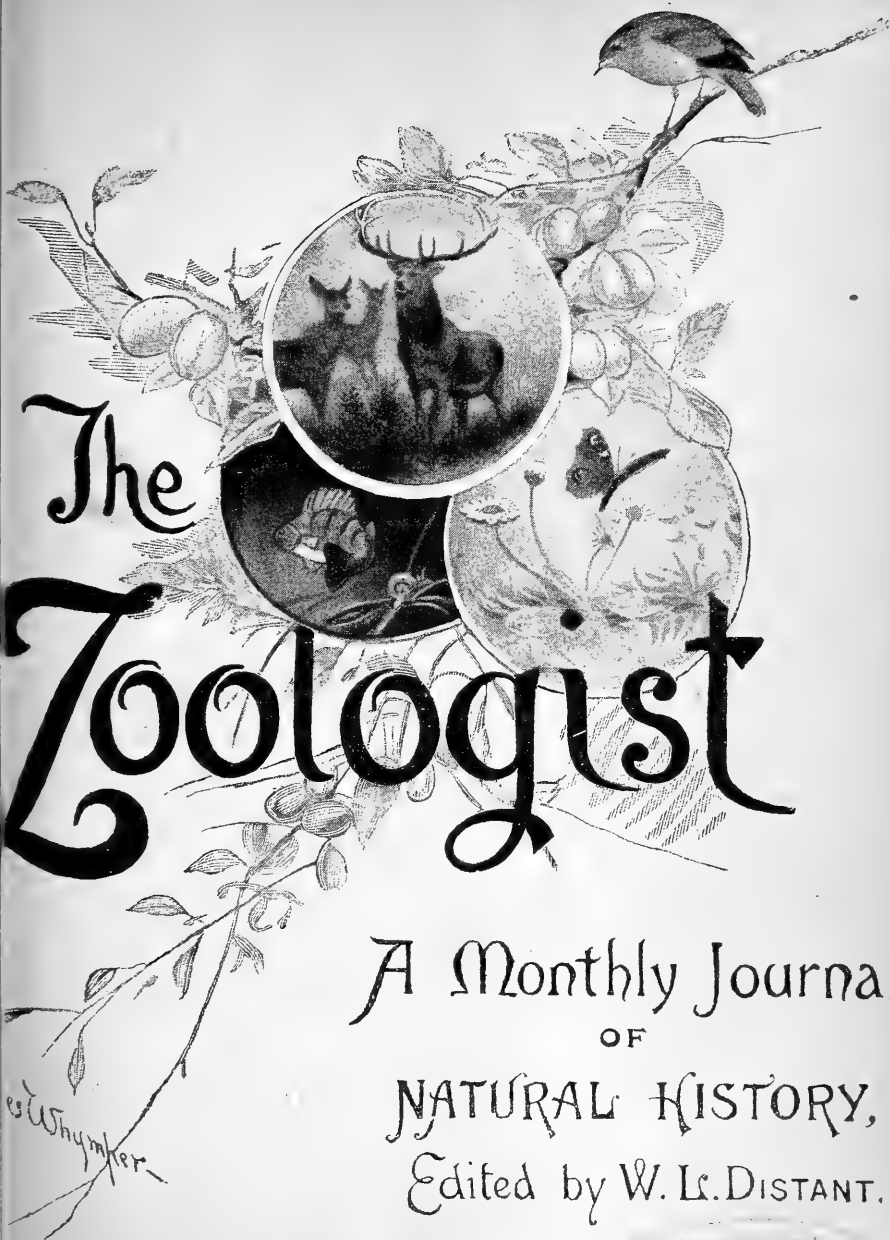
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❧ KING EDWARD VII. has passed away, affectionately mourned by his loyal subjects wherever flies the British flag, and regretted as the great "Peacemaker" by other nations.

❧ As a sportsman he necessarily possessed the inclinations of a naturalist, and the great interest he always maintained in our National Museum of Natural History will not be forgotten.

❧ As Prince of Wales he became one of the Trustees of the British Museum in 1881, a position he continued to occupy till his accession to the Throne. "The History of the Collections" contained in that institution records various donations from the late King, the last of which was the skeleton of 'Persimmon,' one of his triple winners of the "Derby."

❧ Zoologists can only echo the universal grief for a great national loss.

THE ZOOLOGIST

No. 827.—May, 1910.

THE FORMATION OF USELESS HABITS IN TWO BRITISH NEWTS (*MOLGE CRISTATA*, LAUR., AND *M. PALMATA*, SCHNEID.), WITH OBSERVA- TIONS ON THEIR GENERAL BEHAVIOUR.

BY BRUCE F. CUMMINGS.

PART 1.

THE experiments and observations detailed below were made during the past year on two of the British species of Newt (*Molge cristata*, Laur., and *M. palmata*, Schneid.). In studying the formation of useless habits, I employed the labyrinth method, putting the Newts through a simple structure made of wood, and containing several choices between right and wrong. The labyrinth was submerged in a shallow water-tank, containing a small percentage of salt in solution (under one per cent.). A pinch of salt placed on a Newt's back sends it into paroxysms, ending in death, but the slight solution employed in the experiments was found to exercise no deleterious influences, though it brought about the required effect of general discomfort. In the late summer and autumn, when the Newts were leaving the water in preparation for the winter season, I was able to dispense with the salt, as the water alone provided a sufficiently strong stimulus to induce the animals to learn how to get out.

In each case the exit conducted the Newt out of the water in the labyrinth to the place where it had been accustomed to live,

either to a pan of fresh water or to a vivarium. This piece of apparatus, though inexpensive, probably cannot be considered so effective as the employment of a battery, whereby the animals experimented on in a dry labyrinth are given a slight shock every time they take a wrong turn, the motive employed being the desire (only in the spring) to return to the water.

I.

Fig. 1 gives the ground plan of the first labyrinth used. It was made of wood, with the sides of each trough A, B, C $3\frac{1}{2}$ in. high and sloping in, so as to prevent the Newts from climbing

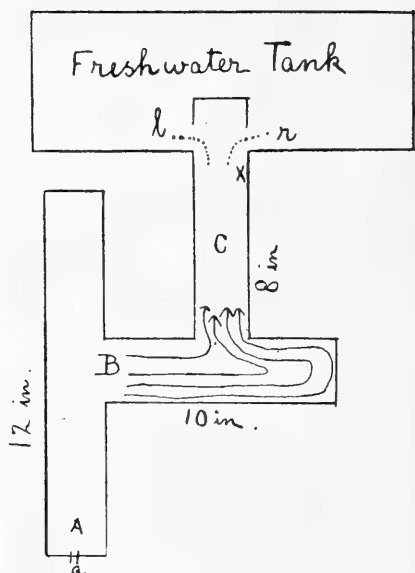


FIG. 1. —a = entrance, Trough A. Trough c slopes up from salt solution.
l, r = left and right apertures into fresh water.

up the sides. Each animal was placed facing forwards at the beginning of the trough a. *Palmates* were employed in all the experiments except where it is specially stated to the contrary. An interval of at least ten minutes was given between each trial up to the end of trial 15, after which the interval was reduced to five minutes.

Table 4* (p. 170) shows that the first Newt reduced the

* The times were reckoned from the moment the Newt began to move in the entrance until its nose reached the top of the slope at the exit.

time occupied in traversing the labyrinth at the first trial from ten minutes to one minute twenty seconds in the 30th trial. After this greater irregularity and an increase in time are shown. The table must be supplemented by the following observations: During the first few trials the Newt wandered about the troughs aimlessly, eventually getting out by chance. At the end of the 15th trial the delay at the ends of the troughs where it "nosed" the barrier was less, and it had made a useless habit of wandering up and down A. Having once entered B, however, it walked to the end, and had formed a sure habit of turning left and so back along the side and into c and out at the exit. This behaviour was not owing to the fact that the animal

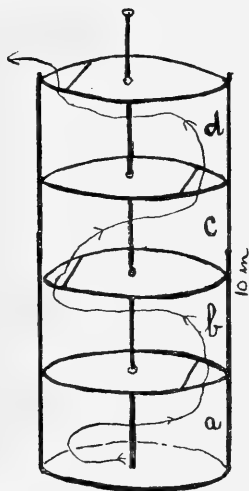


FIG. 2.—Diameter = 4 in.; greatest diameter of hole in each disk = 1 in.

merely followed the wall of the labyrinth all the way, as it frequently turned from the left to the right corner, and *vice versa*, at the end of B before finally going back by turning left. At the end of the 31st trial the Newt learnt to turn directly into c without going to the end of B, but it is interesting to observe that the habit grew gradually, by a process of "accretion," as Dr. R. M. Yerkes has called it,* *i.e.* the distance that it went beyond the opening to c towards the end of B became gradually less and less. This process is shown in Fig. 1; the routes

* Yerkes, R. M.: "Habit Formation in the Tortoise" ('Popular Science Monthly,' vol. lviii. p. 19).

plotted do not, of course, represent those followed in successive trials.

As I expected, it never learnt to traverse the labyrinth perfectly, and up to the end of the 50th and last trial the Newt had formed a useless habit of wandering up and down *a* before taking the turn into *b*. A great deal of energy and time was wasted in trying to get out by climbing up the sides of the trough. The Newts always showed an astonishing persistence in this; its relation to the forming of correct habits I shall mention later on. What I wish particularly to emphasize is that throughout the whole of my work I observed a strong tendency in the Newts to form useless habits, from which no pleasurable results accrued. In some instances, which I shall describe, the habits formed were most elaborately wrong. In trials 10 to 19 the Newt made a habit, on first walking up *a*, of entering the mouth of *b* for a couple of inches, and then withdrawing again into *a*, and so on to the end of it, where, after some delay, it used to turn to the left down to the entrance barrier and up to the mouth of *b* again. On entering it the second time it went on, and finally out at the exit. Then, again, in trials 42 to 48, the Newt, when it had reached a certain distance up *c*, always stopped and placed its nose into the right angle formed by the floor and side of the trough. But there was *no gap in the join and no inequality* which could have produced a stereoscopic reflex.

All my results show the ability in the Newt to form rapidly simple habits of turning right and left; thus, at the end of fifteen trials this first Newt always turned to the left in *b*, and from trials 20 to 38 it escaped by the left aperture of *c* with only one exception. Occasionally it would walk up *c* on the right side, but on reaching a point *x* (Fig. 1) it would walk right across to the left, although it could have got out equally well by turning right. Once it turned across from right to left too soon, so that it struck into the left side of trough *c* instead of at the exit. After a pause the turn to the left was accentuated, so that it almost faced back toward *b*. Finally, with hesitation, it went forwards and out as usual on the left. The animal probably did not cross from right to left simply because it saw the opening on the other side—that would mean an intelligence far too quick for the sluggish Newt—but the instant when to turn

was *partly* indicated by vague motor sensations, by a feeling that it had got up as far as where it had been accustomed to turn, when over on the left side. Sight cannot be entirely left out of consideration, however, although it need not necessarily play any part in helping the Newt to learn the labyrinth.

At the end of the 15th trial, when it had learnt to go around to the left in B, I transposed the two troughs A and B. The troughs were *precisely alike* except in length, and the Newt on going to the end of A (*in the B position*) turned to the left; then a short pause clearly indicated that it was puzzled by the greater length of the opening into c from the end of A. It went on and entered c, but had not gone far when it turned back. The reason for the turning back may very well have been because it thought it was still back in A (*in its original position*), and that c was B, for I have already said that it had formed a habit when first entering B of turning back. Such an illusion was caused by the difference in length of B and A. The experiment also shows that the clue which enabled it to know when to turn to the left at the end of a trough, and to expect the mouth of c a little way back from the end, was the sensation of having previously made a turn to the right, *i. e.* from A into B. The Newt also "felt" when it had gone sufficiently far to meet with the opening into c.

A great deal of time was always wasted by the Newts throughout the course of the experiments, as they invariably turned round and "nosed" the barrier on being first introduced to the labyrinth. On the surface, this behaviour looked exactly as if they realized that they were being pushed through a hole into a trough, and that they inferred from it the precise position of the hole. Here, again, this would be assuming, I believe, too much mental activity in the Newt, and, as a matter of fact, the explanation lies in the well-marked withdrawing response which the Newt gives when confronted with any unpleasant situation, such as bright light, heat, or, as in this case, salt solution. They instinctively shuffle back, and then make a *volte-face*.

II.

Fig. 3 shows the next maze which was used—a very simple structure, offering only one choice. Previously it was found that if the labyrinth was fitted with two exits, one in each passage,

and both equally negotiable by the Newts, they showed a slight tendency to prefer to get out by the left one. Of thirty separate

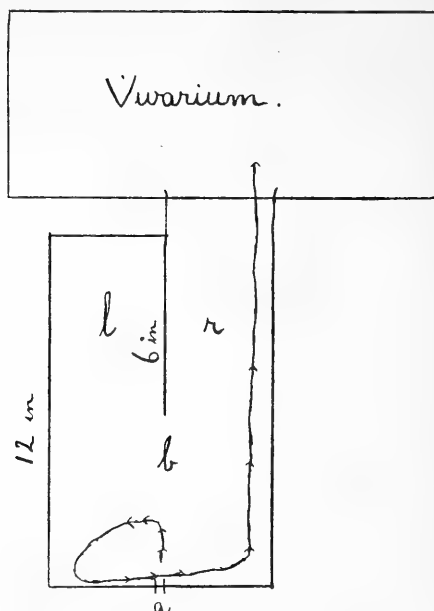


FIG. 3.—*a* = entrance to *b* = the labyrinth under water; *l* = *cul de sac*; *r* = sloping path leading up out of the water. The arrows indicate Newt's courses.

Newts tried in succession, eighteen got out on the left and twelve on the right. The left, therefore, was made the *cul de sac*.

Great Crested Newts were used for this experiment. An interval of ninety seconds only was given between each trial.

TABLE 1. NEWT, No. 1.

No. of Test.	Time occupied.	Route taken.
1.	5 min. 29 sec.	Entered <i>r</i> , back and about <i>a</i> , and finally <i>r</i> .
2.	3 min.	<i>l</i> , <i>a</i> , <i>r</i> .
3.	2 min. 33 sec.	<i>r</i> , <i>a</i> , <i>r</i> .
4.	3 min. 2 sec.	<i>l</i> , <i>a</i> , <i>r</i> .
5.	2 min. 30 sec.	<i>r</i> .
6.	30 sec.	<i>l</i> , <i>a</i> , <i>r</i> .
7.	1 min. 29 sec.	<i>r</i> .
8.	2 min. 5 sec.	<i>r</i> .
9.	2 min. 7 sec.	<i>l</i> , <i>a</i> , <i>r</i> .

TABLE 1.—(continued).

No. of Test.	Time occupied.	Route taken.
10.	30 sec.	<i>r.</i>
11.	52 sec.	<i>r.</i>
	Interval of 20 min.	
12.	6 min. 34 sec.	<i>l, a, l, a, r.</i>
13.	42 sec.	<i>r.</i>
14.	1 min. 22 sec.	<i>r.</i>
15.	1 min. 20 sec.	<i>l, a, r.</i>
16.	2 min. 30 sec.	<i>l, a, r.</i>
17.	35 sec.	<i>r.</i>
18.	32 sec.	<i>r.</i>
19.	1 min. 11 sec.	<i>r.</i>
20.	24 sec.	<i>r.</i>
21.	1 min. 52 sec.	<i>r.</i>
22.	1 min. 27 sec.	<i>r.</i>
23.	1 min. 4 sec.	<i>r.</i>
24.	6 min.	<i>l, a, l, a, r.</i>
25.	15 min.	<i>l, a, l, a, l, a, r.</i>

This table shows that the Newt had formed a correct *r* habit at the end of trial 17, and it is worth remarking that it always oriented itself by “nosing” the left corner, then turning continuously left to the right corner, and up the side into *r*, and so out. The reason for the complete disintegration of the habit at No. 24 was that it had started for the first time in that trial to climb up the sides, and it apparently found the exercise so stimulating that it continued to do nothing else afterwards!

TABLE 2. NEWT, No. 2.

No. of Test.	Time occupied.	Route taken.
1.	4 min. 30 sec.	<i>l, a, r.</i>
2.	2 min.	<i>r.</i>
3.	6 min.	<i>l, a, l, a, r.</i>
4.	30 sec.	<i>r.</i>
5.	2 min.	<i>r.</i>
6.	59 sec.	<i>r.</i>
7.	5 sec.	<i>r.</i>
8.	12 sec.	<i>r.</i>
	Interval of about twelve hours.	
9.	2 min. 29 sec.	<i>r</i> (after hesitation).
10.	5 sec.	<i>r.</i>
11.	21 sec.	<i>r.</i>
12.	—	—

Table 2 proves that No. 2 learnt the correct habit after only three trials. No. 3 diminished its time and mistakes, but had not formed a perfect habit after twelve trials. No 2, like No. 1, did not go straight to *r*, but around by the left from the left of *a*.

TABLE 3. NEWT, No. 3.

No. of Test.	Time occupied.	Route taken.
1.	21 min. 30 sec.	<i>r, l, a, r, a, r, a, l, a, r, a, r, a, l, a, l, a, l, a, l, a, l, a, r.</i>
2.	5 min.	<i>l, a, l, a, r.</i>
3.	1 min. 30 sec.	<i>l, a, r.</i>
4.	6 min.	<i>l, a, r, a, l, a, l, a, l, a, r.</i>
5.	18 sec.	<i>r.</i>
6.	1 min. 10 sec.	<i>l, a, r.</i>
Interval of about twelve hours.		
7.	8 min.	<i>l, a, l, a, l, a, l, a, l, a, r.</i>
8.	11 sec.	<i>r.</i>
9.	1 min. 29 sec.	<i>l, a, l, a, r.</i>
10.	24 sec.	<i>r.</i>
11.	30 sec.	<i>l, a, r.</i>
12.	2 min.	<i>l, a, l, a, r.</i>
13.	2 min.	<i>l, a, r.</i>
14.	3 min.	<i>l, a, l, a, r.</i>
Interval of ten hours.		
15.	9 min.	<i>l, a, l, a, l, a, l, a, r.</i>
16.	29 sec.	<i>r.</i>
17.	10 sec.	<i>r.</i>
18.	out instantly	<i>r.</i>
Interval of thirty minutes.		
19.	7 min. 30 sec.	<i>l, a, l, a, l, a, l, a, r.</i>
20.	45 sec.	<i>r.</i>
21.	out instantly	<i>r.</i>
22.	65 sec.	<i>l, a, r.</i>
23.	10 sec.	<i>r.</i>
24.	15 sec.	<i>r.</i>
Interval of thirty minutes.		
25.	8 min. 3 sec.	<i>l, a, l, a, l, a, r.</i>
26.	60 sec.	<i>r.</i>
27.	90 sec.	<i>r.</i>
28.	out instantly	<i>r.</i>

Table 3, giving the rest of the trials made with the at first incorrigible No. 3, shows that it had formed a correct *r* habit at

No. 16, which became partially disintegrated after a thirty minutes' interval, but was very rapidly re-acquired. Three more Great Cresteds were tested, the trials succeeding each other at the same pace with periodic intervals. They all showed rapidity in forming the simple *r* habit of movement, and equal rapidity in losing it. Another was tested *at intervals of fifteen minutes*, and at the end of twenty successive tests completely failed to form any *r* habit.

The Newt's capacities for forming simple movement habits were also tested by putting them in salt solution contained in narrow bottles with variously shaped necks. A glance at Fig. 4 shows that the trick to be learnt was a reversal of their position, and then out at the top. The first bottle was learnt, on an

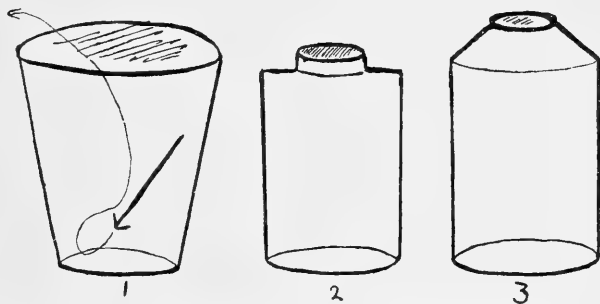


FIG. 4.—Height of each bottle = 6 in. Diameter at the bottom = $3\frac{1}{2}$ in. to 4 in.

average, after three trials. The first trial always showed the Newt persistently "nosing" the bottom. The second and third usually saw the time reduced to its smallest limits. The time occupied in the initial "nosing" in No. 1 trial varied a great deal, but rarely exceeded three minutes. It is all the more surprising therefore to find that a certain male of *M. cristata* nosed the bottom for forty minutes, after which more salt was added, with the result that it shot out quickly. The second trial occupied sixty-two seconds; No. 3, three minutes forty-five seconds; No. 4, twenty-five seconds; after which the time was reduced, in two more trials, to the minimum. The fact that this particular Newt was very thin and emaciated is suggestive. The necked bottles made very little difference in the rapidity with which the Newts learnt to reverse, the trick being acquired in from five to six trials as a rule.

In some cases the Newt, in the first trial, *immediately* got out; in others, it attempted to reverse at once, but was unable until, after the practice of several trials, it had learnt to bend its body circularly, or, as was the habit of some, to force themselves up straight without bending. Intervals of two minutes were allowed between each trial; it was again seen that these simple movements were readily lost after intervals of sixty, forty-five, twenty, and ten minutes. I observed, however, that the Newts showed unmistakable signs of the influence of their previous training, although this more rapid re-acquirement would not be shown on paper by giving the time records.

TABLE 4.

No. of Test.	Time.	No. of Test.	Time.
1.	10 min.	20.	10 min.
2.	1½ min.	21.	4 min.
3.	2 min. 30 sec.	22.	8 min.
4.	3 min. 20 sec.	23.	2 min.
5.	30 sec.	24.	2 min.
6.	5 min.	25.	3 min.
7.	13 min. 30 sec.	26.	3 min. 10 sec.
8.	4 min. 20 sec.	27.	1 min. 30 sec.
9.	6 min.	28.	1 min. 10 sec.
10.	10 min. 30 sec.	29.	4 min. 30 sec.
11.	4 min. 10 sec.	30.	1 min. 20 sec.
12.	5 min. 50 sec.	31.	5 min. 40 sec.
13.	14 min.	32.	12 min.
14.	5 min.	33.	8 min.
15.	7 min. 20 sec.	34.	2 min.
16.	2 min. 30 sec.	35.	7 min. 30 sec.
17.	8 min. 30 sec.	36.	7 min.
18.	4 min.	37.	2 min. 30 sec.
19.	4 min. 40 sec.	38.	3 min.

III.

One form of labyrinth used was a spiral, which was placed vertically in a large glass jar (see Fig. 2, p. 163). Table 5 gives the particulars.

This labyrinth took advantage of the Newt's "nosing" instinct, as all it had to do was to "nose" the roof of each storey until it hit the opening. The learning of the maze also involved nothing but the Newt's motor sensations and the sense of touch,

as the senses of hearing, taste, and sight could be neglected, especially the latter, because the light was made to play as evenly as possible on all parts of the glass jar, and on more than one occasion the Newts showed that they did not really *see* their way up, for they would "nose" along the roof to the very edge of the opening in it, and then draw back again. *M. cristata* was the species used.

TABLE 5.

No. of Test.	Time.	Observations.
1.	4 min.....	Nosed in each storey.
2.	2 min. 30 sec.	
3.	1 min. 30 sec.	
4.	4 min.	
5.	2 min. 20 sec.	No nosing in <i>c</i> .
6.	3 min. 5 sec.....	
7.	4 min. 39 sec.	
8.	4 min.	
11.	2 min.	Pronounced nosing, especially in <i>b</i> and <i>d</i> .
12-20.	1 min. 30 sec.-4 min. 15 sec.	Only nosed in <i>b</i> . Nosing only in <i>b</i> and <i>d</i> . Walked always to the left of the pillar in <i>c</i> . In No. 19 it rose in right corner of <i>c</i> , contrary to custom, but it crossed over to left. The same thing occurred in No. 20.
21.	1 min. 50 sec.	Rose in right corner of <i>c</i> , and went to the <i>right</i> of pillar to the end of No. 40.
25-31.	1 min. 55 sec.-3 min.	In <i>b</i> went left of pillar, in <i>c</i> right, and in <i>d</i> left. Nosing very reduced,
32.	2 min. 55 sec.	Delayed in <i>b</i> , nosing, and went right. Similarly in Nos. 33 and 34.
35.	1 min. 15 sec.	In <i>b</i> went left, <i>c-r</i> (right), <i>d-l</i> (left). Nosing in <i>b</i> and <i>d</i> .
36.	4 min. 44 sec.	In <i>b-r</i> , <i>c-r</i> , <i>d-r</i> . Nosing badly.
37-40.	1 min. 20 sec.-4 min. 5 sec.	In <i>b-l</i> , in <i>c-r</i> , in <i>d-l</i> . Nosing less.
41.	3 min.	In <i>b-l</i> , in <i>c-r</i> , in <i>d-r</i> . In <i>d</i> turned as if for left, but fell into right corner, and so around.
42.	3 min. 30 sec.	In <i>b-l</i> , in <i>c-l</i> , in <i>d-l</i> . Nosing badly everywhere.
43.	8 min.	In <i>b-l</i> , in <i>c-l</i> , in <i>d-r</i> . Nosing badly.

Table 5 gives the results of an experiment with a Newt which first of all was placed in the water of the jar when the labyrinth was immediately slowly pressed down upon it into the jar. The animal was placed facing directly away from the opening leading from the lowest storey *a* to the next *b*. It would first begin to nose the roof of the first storey, going round after a delay either to the right or the left corner, where it would rise and immediately re-begin nosing in *b*. After at first a lengthy delay it would nose around to the second opening, going either right or left of the pillar. And so with the other storeys, the last one leading it out into its vivarium home. The table shows that the Newt at the end of the 25th test had formed an almost perfect habit of climbing up through the spiral without making any delays by persistently nosing at one place as previously. Later, nosing set in again, in an acute form, perhaps the result of fatigue and the consequent relaxation of inhibitive control of its instinctive stereoscopic nosing responses. The trials lasted over four days, and fifteen minutes' interval was allowed between each trial. It should be understood that the Newt never learnt to climb up the spiral, without *any nosing at all*; it nosed its way all round the spiral, but showed its capacity for learning and inhibiting by not wasting time in nosing in one place only. It kept on the move in the right direction.

The table also shows that the Newt early formed a fixed habit of going to the left of the central pillar in *c*, and it is important to observe that it was in *c* that it first learnt to cease making any delay through nosing. Further, it will be seen that in general as the nosing becomes less in the three storeys, so fixed habits crystallise out. For example, a left-right-left habit was formed in the three succeeding storeys *b*, *c*, *d*, after delays had been cut out. In 32 it nosed in *b* and went right. See also 36, 42; and, although it is not shown, the whole of the tests up to about 20 gave no regular habits, right or left, in *b* and *d*, because it was in these two storeys that the Newt delayed, always nosing with a persistence which, if it had been intelligent, would have been called "determination," but, being useless and unintelligent, must be described only as "stubbornness." These habits of movement right or left are significant, for it is to be observed

that the animal could always attain its end equally well by going either side of the pillar.

That the habits of turning had intimately insinuated themselves into the Newt's nervous system was shown in trials 32, 33, 34, and 36, where the Newt turned according to habit, although it had, at the beginning in *b*, made a wrong turn which, on account of the structure of the labyrinth, was bound to alter the circumstances of the other turns, in this instance leading the Newt up into *c* on the *right* side instead of on the *left*. In 32, 33, and 34 also the *d* turn was correct as well. No habit, however strong, seems to be able to form and permanently withstand the disintegrative effects of the strong nosing instinct. Similarly with its impulsive side-climbing in the other labyrinth.

The times in the table do not signify much, as a Newt would sluggishly traverse the spiral with no mistakes, while an energetic control would invariably get through much quicker, yet it made, of course, every mistake possible.

IV.

Other labyrinths were tried, but no Newts learnt them permanently, on account, as in the others, of the climbing propensities. Several Newts, however, presented interesting aspects in their behaviour, and one, a Palmate, formed a useless habit, lasting over a period of nine trials, of climbing up the side of the corner of a trough, nosing the glass top over the trough (only two inches up in this case), until it overbalanced itself and fell into the exit trough, and so out. All this, and it might have simply turned and got out in half the time! The same Newt, over the same period of trials in the same labyrinth, formed two other habits. In the first, it would always return to the mouth of the first trough and retire again to the next, eventually entering the first completely down to the entrance barrier, and then going forward to the third trough (omitting the second), out of which it fell, in somewhat the same way as in the last trough already detailed.

The most remarkable case of the elaboration of useless habits occurred in the labyrinth, Fig. 5, which somewhat resembles the labyrinth used by Dr. Yerkes for testing the learning powers of

the Frog.* A male Palmate, in trials 16, 17, 18, entered *r*, and in pursuance of a curious habit (somewhat similar to what occurred in other labyrinths with other Newts, as I have described) withdrew when about two inches in. In Nos. 18 and 19 it had formed another habit of turning a complete circle to the right when in *l*, starting from a position facing the blind end. Finally, in 19, an additional habit was made of returning to *l* again, just after leaving it, when it had reached only half-way down to the entrance barrier. In 20 all these useless habits appeared *en masse*, as is indicated by the dotted line of the

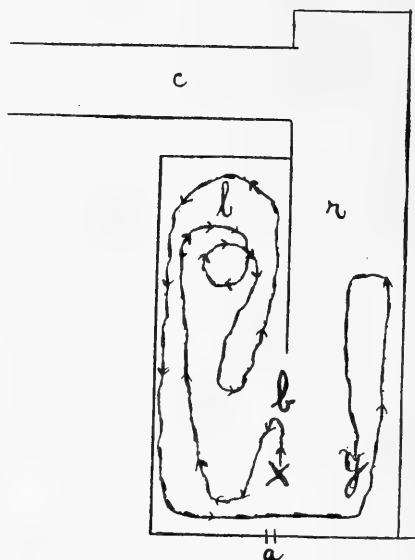


FIG. 5.—*a* = entrance to *b* = the labyrinth under water; *l* = *cul de sac*; *r* = passage leading to *c* = slope from water up to vivarium; *x* = the start of Newt's route; *y* = the finish.

Newt's route. In 21 the same course was made, with the elimination of the *r* habit, although it clearly hesitated, and made as if to turn, but went on.

In the same labyrinth I obtained a good instance of the struggle for existence of two distinct habits. A strong *l, r* habit had been formed, in which the Newt climbed up in the *l* box at a certain spot on its right side, so that, by climbing and moving

* Yerkes, R. M.: 'Harvard Psychological Studies,' vol. i.

slightly to the right, it was able to fall out and across the entrance of r , into which it turned. The next day it merely walked out of l , but on the left side, and *inclined towards* r between x and y in the figure. It did not turn into r , but around by a . The second trial, the same route was taken. I have no record as to what happened on the third, but on the fourth it went through the climbing process and fell out, and for the first time immediately turned into r . Precisely the same thing happened in the next trial, but afterwards the l , r gradually gave way to the l , a , r . The "fall out" appeared to revive the habit of the day before, which a new habit finally overcame.

(To be continued.)

AN OBSERVATIONAL DIARY ON THE NUPTIAL HABITS
OF THE BLACKCOCK (*TETRAO TETRIX*) IN
SCANDINAVIA AND ENGLAND.

BY EDMUND SELOUS.

(Part II. ENGLAND.)

(Continued from p. 56.)

May 5th, 1908.—Arrived yesterday, and was driven to one of the Blackcock *leks*, in the afternoon, by the keeper, who arranged to call me at my lodging, at 3, the next morning. He was late, however, so that we did not get to the place quite in time. There were some four or five to half a dozen male birds there, and as I came up, now in a drizzling rain, I could see them springing at one another. In getting into place, behind one of several thinly scattered thorn-bushes, I probably disturbed the birds, who went up, and flew to a little way off, but as they returned, very shortly, and remained upon the open, somewhat swampy, space chosen by them, for more than an hour, seeming quite at their ease all the time, they could not, I think, have been much alarmed, even when they went off. But there was, now, no further fighting, or, indeed, any activity at all, the birds merely standing quietly, without doing anything, which I attribute, and hope may be attributed, to the rain, which had come on more and more, nor was there any intermission in it, till the meeting broke up. This morning, then, was quite a failure.

May 6th.—Started off, in the dark, on my cycle, about 2.15. Yesterday I had ridden the keeper's horse, for half the way, going turn and turn about with him, but pushing the cycle up the long steep hill which has to be surmounted in order to get to the place—on the side of a higher hill—was a different matter. However, I was on the spot, and seated behind the gorse-bush I had chosen, yesterday, some little time before 4,

and before any birds had come. It was about a quarter of an hour later, and when the light was still very dim, that I began to hear them, and, from the sounds, judged that a good many—perhaps a dozen—cocks were assembled. Besides the peculiar harsh grating note which seems so well fitted to express anger, there was that soft, plaintive one which sounds quite opposite in character, but is really far more its concomitant, since it is generally, if not always, uttered when two birds stand opposite one another, and seem on the point of engaging, though, whether through nervousness, or lack of courage, it is seldom that they actually do engage. Most noticeable, however, and continuous, was the pretty, musical “whirbling” (as I have called it), whether more subdued than when uttered in Scandinavia, under exactly similar circumstances, I am not quite sure, but certainly far more so than as the birds there produce it, when perched amongst the fir-trees, for here on the moors trees of any kind are wanting. As it grew lighter, by degrees, I saw the white tails of the cock birds flashing here and there, through the gloom, and then the rich, deep black of the general plumage, against which, like the wing-plumes of the Ostrich, they stood beautifully out, till, at length, the whole bird, and all his actions, became plainly visible. These consisted of advances, with spread tail, towards one another, more or less swiftly, along the ground, with occasional excited leaps into the air, just as, last year, in Sweden, but here, as there, I saw nothing of that sustained and exaggerated energy which upon some, though, as I begin to think now, only exceptional occasions, renders this performance so extraordinary a one.

It was not till a good deal later, when the light of day had properly asserted itself, that either hen birds began first to appear upon the scene, or I first to notice them. These were courted by the cocks in the same manner as described in my notes of last year, but a new and interesting feature was now present, or observable by me, for one hen would often chase another furiously over the course, and, on at least one occasion, two fought together, spreading out their tails and leaping at each other, like more slightly made cocks. In the chase they ran with great speed—much greater, it seemed to me, than I have ever seen attained by a male—and, stretching their bodies

forward and upward, became much slighter- and thinner-looking. I was lucky in, more than once, seeing the occasion and meaning of such pursuits and flights. Thus, with wing lowered upon the side towards her, and with his whole body tilted in the same direction, with tail turned so as to show its full outline, the white of it being splendidly conspicuous, and with lowered bull-like head, a fine cock bird—though they were all fine—was making little swelling runs, in curves, backwards and forwards, about the object of his desire, who, on her part, would make a funny little run, and then stop, then run and stop, again, and so on, showing most plainly, as any actual observer, I think, must have recognized, that she understood the significance of this courtship well enough. At any moment she could, had she pleased, have flown or run right away from it, but, thus moving, and keeping, first, in one direction and then in another, within a certain limited area, which was very conspicuous to me, she preferred to let it continue. All at once, another hen came into this same area, and within a few yards of her, upon which, with every sign of jealous rage, she precipitated herself upon this conscious or unconscious rival, who, surrendering forthwith, fled for life, and was chased right away, each bird exhibiting, as I say, very great speed. Here then the very essence of the drama was clearly unfolded before me. No hen bird could act, under such circumstances, in so furiously aggressive a manner, and yet be indifferent to the male's advances, and this, if that strange myth of the hen's indifference* still survives, makes the observation here recorded a valuable one, nor, as I say, did it stand alone. On the one or two occasions on which hen birds positively fought, I imagine that the cause was the same, without similar yielding on the part of one of them, but I did not see this with my own eyes. Nothing could show more plainly what these meetings represent, for both sexes, than this combative mood of the hens.

It was when one cock was courting a hen, and the movements of the latter brought him near to another, that a combat was

* I do not, of course, mean that any hen bird may not, upon any occasion, and for various good reasons—such as hunger, satiety, or a preference elsewhere—be indifferent to this or that male—even the favoured one; but only that the indifference of the female to masculine courtship, *as such*, is a myth.

most imminent. In such cases the first bird would rush out towards the one approached, who, on his part, might advance to meet him, or himself to court the hen; yet I witnessed only one determined fight. Here the birds sprang at each other, with fury, and the buffetings which they bestowed with their wings made a loud noise. It, however, lasted but a short time, nor were the general features of the campaign other than as in Sweden, *viz.* much threatening and fronting one another, with the curious plaintive-sounding cry, but mutual chariness in beginning. I saw only one actual pairing (coition), but, except that the hen gave voluntary signal for this, I did not catch the circumstances that led up to it. The assembly-ground was only some thirty or forty paces from where I sat, and looked down upon it from a slight elevation. Except for some tufts of grass, there was nothing to hide the birds, but much of the space was quite open, and, on the whole, a better view could hardly have been obtained.

May 7th.—First “whi-i-i-ish” note at 3.30 a.m., followed almost immediately by the plaintive “chirrer” one, and then the whirble. I am, therefore, only just in time, having taken my seat some five minutes before, when everything was still, though I put up one bird as I walked over. For the rest, this morning is but a repetition and confirmation of yesterday. The hens are assiduously courted by the males, and they occasionally fight, spreading out their tails when they do so, which are then seen to have some white in them, as well as those of the cocks. But this is confined to the tips of the feathers, which appear as little white spots, running round the circumference of the fan—at least the eye distinguishes no more. One hen also is sometimes chased away by another, which means, of course, that there would be a fight did not this other flee. For the rest the hens seem hard to win, and I only saw one case where a cock was successful in his desires. A tuft of grass, indeed, hid the actual sight of this from my view (as it may have done in other cases), but there could be no mistaking the conduct of the hen, when she emerged from behind it, consisting, as it did, of several very satisfied little motions, ruffling and shaking the feathers, and then a vigorous preening, of which there had been no hint before, nor was it in the order of things.

Though, as I say, the hens seem hard to win, yet they look quite conscious of being courted, and the fact that, as a resultant of this, pairing does, from time to time, take place, as well as their jealousy of one another, is proof that they are not indifferent, although they may be nice. That they should be nice does not appear to me to speak against, but rather for, the hypothesis of natural selection, for as the males became all more attractive, the hens should become more critical—the one factor could not operate without the other. So, too, the hens appear to be won by courting, and not by fighting. This was so in the one case of coition observed by me this morning and yesterday, for though, as I say, I did not happen to have my eyes on those particular pairs, rather than others, just before it, yet fighting even to a moderate extent must certainly, on so confined a space, have caught my attention. Moreover, on the whole, there is but little fighting amongst the cocks—at any rate, it is not nearly so important a feature as seems to be generally imagined. For the most part, the birds threaten merely, and, even when they do close, it is but seldom that one hears the loud flaps and buffets with the wings, that give evidence of any considerable fight, nor do they last for any time when one does hear them.

Though the cocks court the hens in a very business-like manner, and, as one may say, patiently, yet they sometimes lose patience, and make either a little run or a little spring at them. I have seen one instance of the former and two of the latter, but not once was the attempted ravishment, as it seemed to be, successful. In the first instance, the hen ran, and, in the two last, she flew away.

The monosyllabic, barking cry of the hen—like that of the hen Capercaillie, but much less guttural—was a good deal in evidence this morning.

May 8th.—Left the cottage at about 2, and was seated well before 3.30, at which time everything was still as death. In ten minutes or a quarter of an hour, the first notes of the cocks were heard, and for a long time, as far as I could see or hear, they were on the place by themselves, without any hen. They would either stand, for some time, more or less quiet, or else whirling; or, with a little jerk upwards, and flap of the wings, they would

bring out the angry "whush," or this jerk would be exaggerated into a more or less high leap, which, again, would sometimes pass into a short flight from one part of the arena to another.

Besides the above-mentioned actions, one bird would often run at another, sometimes for nearly the whole length of the ground, or two would so meet, and then stand fronting, and threatening to leap at, one another, which, however, they but seldom did, nor was there anything that really deserved the name of a conflict. Here, again, we have something very different from the popular idea of these things, which supposes continual violent conflicts between rival males met to court and fight. Instead—here as with the Ruffs—such conflicts are few and far between, and, when they do take place, last but a very short time—often not more than a few seconds. The birds seem simply to lack the courage to fight. They come on with every appearance of rage, then stop, face to face—almost always with that peculiar note so different in sound and character—turn about, stand with dilated feathers, and bent heads, side by side, front one another again, make an abortive half-spring, think better of it, and then separate, one or both returning from whence they came. They do everything, in fact, *but* fight, but in that they make a very tame and poor figure. Still, if they actually do make a spar or so, it is with all the violence that could be wished, but the flame that has leapt suddenly up expires as suddenly. Now and again, indeed, there is a fight of some twenty seconds or so—even perhaps a minute—and then it makes a fine show. But, after all, what is it in itself compared to the furies of Sparrows or Blackbirds, of a pair of Tits, or to those long rancorous combats of the Redshanks or Kentish Plover which I have witnessed and described? * It is only because of their size and bold plumage that it makes a superior effect. Dress them in drab and reduce them by half or a quarter, and there would be little to say of it. I am speaking, of course, to the extent of my observations, but it seems strange that those made in Sweden and here should so tally, if they do not represent the general rule. In Norway, too, it must be remembered—I shall never forget it myself—that the very bird that made such a

* Cf. "Observations tending to throw Light on the Theory of Sexual Selection" in 'Zoologist' for June, 1906, &c.

prodigiously warlike display slunk quietly away, a poor tame thing, on the entry of another male into the arena.

It was some time, this morning, before I perceived first one, and finally two hens, which were courted by the various cocks as they passed over the ground, in the usual way. This led to some furious rushes, and a spring or two, between bird and bird, but even now there was nothing heroic. To the courting actions which I have already described, another is now to be added—which I also saw several times yesterday—the sinking down, namely, of the male before the hen, and remaining so, for some seconds, with wings slightly expanded and touching the ground—the prostration, in fact, of the Ruff, but not so pronounced. For the hens, they walked, warily, about amongst the males, for the purpose, apparently—it is difficult to think of another one—of being courted by them. From time to time one would crouch before her admirer, but I only saw one case of actual coition, and it is significant that this took place in precisely the same spot—behind the same tuft of grass—as it did yesterday; presumably, therefore, with the same male bird, since the latter, on the whole, have their special places on the courting-ground. Immediately afterwards two other cocks came rushing up in a great state of excitement, and the three swelled and bustled about together, but here, too, there was no actual fighting—not even a blow or two. Soon after this the hens left, and the business of the morning seemed over, perhaps damped by the perpetual, sharp, pelting rain. Most of the cocks, too, soon flew off. I had never been able to count more than six, at one time, on the ground, but as, when I rose to go, four more flew up, there must really, I suppose, have been a greater number—perhaps eight—but not, I think, more than that, together.

At 6 I met the keeper, by appointment, at the foot of the hill, and went with him to be shown “a noted place” for the assembling of Blackcocks, just off a long, lonely road over the moors. It was another weary toil, almost all up hill as before—(so that the cycle helps little except to come back)—and as far again as I had come. Having got there I marked the place with a small heap of stones, and purpose to come again to-morrow before light, starting about 12.

(To be continued.)

NATURAL HISTORY RECORD BUREAU (1909) :
THE MUSEUM, CARLISLE.

By D. LOSH THORPE & LINNÆUS E. HOPE, Keepers of the
Records.

IN the report from this "Bureau" for last year (1908) we referred to the visits of a wild Whooper Swan to the River Eden, and hazarded the opinion that this bird had not yet paired, and that it would be interesting to see what might happen when that important incident in the life of a bird took place. Wild Swans, it is believed, pair for life, and for that reason we felt that if our bird was a female, as we imagined, her mate would be induced to follow her to her winter quarters. This has really happened, and more, for the pair are accompanied by two more birds of the same species—not a brood, but adult companions.

These four Wild Swans arrived on the Eden on the morning of Dec. 24th (Christmas Eve), and were immediately reported by the park-keeper, T. Hudson. Mr. D. Losh Thorpe saw four Swans flying towards the river from the north-east at the hour they were seen to arrive by the keeper—no doubt the four Wild Swans.

The presence of four Wild Swans, or even of one, in such close proximity to the haunts of men is, as we have said before, most extraordinary, Wild Swans being amongst the shyest and most suspicious of wild animals. Carlisle is indeed a favoured place, the honour of entertaining such distinguished visitors being afforded to few places; such an occurrence has never before been recorded in this country. Several other interesting occurrences are reported during the past year.

Mr. D. Losh Thorpe records a bird new to Cumberland—the Stone Curlew, or Great Plover. A bird of this species was seen by him on the banks of the River Eden, at Caldew Foot, on the morning of March 27th, 1909.

The date of the occurrence coincides with the arrival of the species in the South of England this year. It was evidently a bird which had over-reached the usual northward migration limit, and was resting and refreshing itself by the river. It had gone

later in the day, as a careful search failed to again reveal it. The Stone Curlew is a most interesting bird ; we have kept it in captivity, and have studied its habits in its breeding haunts in Norfolk. It is not a common bird in Britain, and is extremely restricted in its distribution in this country, there being only a few favoured spots in the South of England where it is to be found breeding.

Another extremely rare bird in the district (the Wryneck) was killed by telegraph-wires near Drumburgh on June 27th, 1909. James Smith, who dissected the bird, said it was a female, and had evidently been nesting. The Wryneck has only been recorded in two instances in Cumberland during the last fifty years, but T. C. Heysham records it as breeding regularly near Carlisle in his time.

A new bird has been added to the Westmorland list—the Golden Oriole (*Oriolus galbula*). An immature male bird of this species was picked up dead in the vicarage garden at Brathay, near Windermere, on May 16th, 1909, and sent to the Carlisle Museum by the Rev. T. H. Baines, who said it had been seen on the previous day by his neighbour, Mr. Whitwell. Six degrees of frost were registered on the night of May 15th, and this no doubt was responsible for the death of the rare and delicate straggler.

In the early part of the year (Jan. 2nd) a flock of Snow Geese were reported to have been seen on the Solway. They were flying west, and were seen near Annan by two gentlemen, who had a good view of them as they flew close over the golf-course. The visits of this Nearctic species to the Solway have been few and of short duration ; there has never been any possibility of obtaining an example to fully authenticate their occurrence. Wild Geese were again numerous on the Solway marshes, and six species were reported on the Cumberland side, *i. e.* Grey Lag, Bean, Pink-foot, White-fronted, Barnacle, and Brent. The Grey Lag has been fairly numerous ; in fact, Mr. W. Nichol says that in his locality more Grey Lags than any other species were killed, the next in point of numbers being the Barnacle. The Pink-foot is, however, the predominant Grey Goose, and the White-fronted the rarest. The Barnacle is not quite so numerous as it was ten years ago.

Two interesting Ducks were obtained on the Solway in early winter, one being an adult male Garganey, a bird not often met with on the Solway, in full eclipse plumage—an interesting stage of plumage; the other an adult male Long-tailed Duck in full winter dress. The latter species has occurred fairly regularly on the Solway since 1884, but this is the first time it has been obtained in this dress, and it is also noteworthy that the date (Nov. 2nd) is extremely early for the assumption of the full winter dress.

The summer visitors, as a whole, were much earlier in 1909 than in the preceding year, despite the cold spring and late frosts which lasted into June. The first Wheatear, which is our earliest migrant, was noted on March 25th, as against April 4th of 1908. The Swallow was seen six days earlier, and the Sand-Martin ten days earlier. The Willow-Warbler was reported three weeks earlier than in 1908. The Cuckoo, Corn-Crake, and Swift were each ten days earlier, and the Chiffchaff eight. There is still much to learn respecting the migration range of our summer visitors, and we do not yet know to what extent local movement takes place amongst our resident birds. It is, however, hoped that a system of marking birds by placing an aluminium ring upon a leg with certain distinguishing marks thereon, which has been commenced in many places, will throw some light upon this subject.

We marked a number of birds last year in this way, and if any birds should be found bearing a ring of this sort, we will be pleased to have them sent on to us, with particulars of date and place of capture. Our special mark on the rings is "Carlisle, '09," and number.

There is little to report respecting Mammalia, but Mr. T. Nichol, of Skinburness, came across a Hedgehog in the very act of devouring the young birds in a Thrush's nest. A female Badger weighing twenty-four pounds was caught in a Rabbit-trap near Longtown, and several others were seen or caught in North Cumberland during the year. It is evidently holding its own there. The Slowworm (*Anguis fragilis*) is not a common reptile in the Carlisle district. One was taken at Aspatria on Aug. 18th. and sent to the Museum by Mr. H. Thompson. The following are a selection from the notes and records sent in to the Bureau:—

1909.

January 2nd.—A flock of Snow Geese reported as seen near Annan, on the Solway (Major S. Ferguson).

7th.—Mistle-Thrush heard singing near Windermere (W. E. B. Dunlop). During January, Wild Geese, especially Bean, were numerous; Mallard were very scarce (W. Nichol).

February 2nd.—Five Brent Geese seen near Silloth. They were very shy (W. Nichol).

4th.—Song-Thrush heard singing near Windermere (W. E. B. Dunlop).

11th.—Wild Geese, especially Pink-feet, numerous on Rockliffe Marsh, apparently over two thousand birds; amongst them is a peculiarly light coloured example, presumably a pale variety (Major S. Ferguson).

18th.—A Hawfinch was picked up in a garden at Great Corby. It died a few days later (Mr. Telford).

28th.—The Whooper Swan has at last returned to its old place on the River Eden. It is very late (J. B. Cairns).

March 17th.—Curlews passing over Carlisle (D. Losh Thorpe).

19th.—Two Pintails and twelve Bean Geese near Silloth (W. Nichol).

20th.—Great Spotted Woodpecker seen near Carlisle; Corn-Bunting commencing to sing; large number of Sky-Larks passing over Carlisle on migration (T. L. Johnston). A dark, heavy, misty night; a large number of birds passing over Carlisle on migration. Heard notes of Curlew, Lapwing, Black-headed Gull, and Sky-Lark. A Blackbird struck the high telegraph-wires in Lowther Street (D. Losh Thorpe).

21st.—A flock of Redwings singing in Troutbeck Valley (W. E. B. Dunlop). Large migration of birds continued over Carlisle. Species noted were: Black-headed Gull, Lesser Black-backed Gull, Curlew, Lapwing, Ringed Plover, and Redshank. Mild, misty night; wind S. and S.E. (T. L. Johnston & D. Losh Thorpe).

22nd.—About two hundred Wigeon seen near Silloth (W. Nichol). Badger trapped near Longtown (R. Davidson).

25th.—A Wheatear was seen at Silloth to-day (first record of the season) (D. Losh Thorpe).

27th.—Some Redshanks are frequenting a low-lying meadow near Morton, Carlisle (T. Hutchinson). A Great Plover or Stone Curlew was seen on the River Eden to-day near Caldew Foot. This is the first record of a visit of this species to Cumberland (D. Losh Thorpe).

28th.—Wheatear seen at Silloth (W. Nichol).

31st.—Large number of Blackbirds on migration near Silloth (W. Nichol). First Wheatear seen in Windermere district (W. E. B. Dunlop).

April 1st.—Three pairs of Rooks have built their nests on chimney-stacks of houses at Holme Head, Carlisle (R. Leighton). A Knot in the aviary at Loshville is showing the first signs of summer dress—a few red feathers on the head and neck (D. Losh Thorpe).

4th.—Saw the first Wheatear to-day at Leegate (R. Mann).

5th.—Sand-Martin seen at Rickerby, Carlisle (W. Little).

6th.—Five Pintail Ducks seen at Silloth (W. Nichol). A Swallow seen at Silloth to-day (D. Losh Thorpe).

8th.—A Sand-Martin seen at Silloth (J. J. Hodgkinson). Nine Wigeon seen at Silloth (W. Nichol). Swallows seen at Crosby-on-Eden (W. H. Little). Willow-Warbler seen at Leegate (R. Mann).

9th.—Chiffchaff seen and heard at Middle Gelt (T. L. Johnston). Swallow seen at Crosby-on-Eden (E. Hodgson). Swallow seen at Newcastleton (W. Roden).

10th.—House-Martins and Swallows at Caldew Foot (D. Losh Thorpe). Swallows seen at Skinburness, Silloth (Ernest Carr).

11th.—Eighty to one hundred Wigeon on the Solway, near Silloth (W. Nichol). Swallows, Sand-Martins, and House-Martins are on the Eden (D. Losh Thorpe).

12th.—About fifty Wigeon and thirty Bar-tailed Godwits are near Silloth, on the Solway (W. Nichol). Swallow seen at Scotby (Ernest Carr). Wheatear seen at Silloth (T. W. Sharp).

16th.—Two Swallows seen at Leegate (R. Mann). Willow-Warbler seen at Cotehill, near Carlisle (W. H. Little).

17th.—A large flock of Fieldfares at Leegate (R. Mann).

18th.—House-Martins and Sand-Martins first seen at Windermere (W. E. B. Dunlop).

19th.—Corn-Crake first heard at Cargo, near Carlisle (T. Robinson). Sandpiper seen at Wetheral, near Carlisle (T. L. Johnston). Cuckoo heard at Penton (W. Roden). Willow-Warbler heard first time this year in the Windermere district (W. E. B. Dunlop).

20th.—Cuckoo heard at Cargo, near Carlisle (T. Robinson). Swallows arrived at Troutbeck, Windermere (W. E. B. Dunlop). Corn-Crake heard at Morton, near Carlisle (T. Hutchinson). Swift seen at Etterby, Carlisle (D. Losh Thorpe).

21st.—The Whooper Swan on the Eden appeared restless (it had left the following day) (D. Losh Thorpe). A Redstart, also a Hawfinch, seen at Crosby-on-Eden (E. Hodgson). Cuckoo heard at Leegate (R. Mann).

22nd.—Corn-Crake seen near Allonby. The Black-headed Gulls are hard at work building; only saw one egg (Major S. Ferguson).

23rd.—Corn-Crake heard at Penton (W. Roden). Yellow Wagtail seen at Troutbeck, Windermere (W. E. B. Dunlop).

24th.—House-Martins arrived at Leegate (R. Mann). Redstart seen near Windermere (W. E. B. Dunlop).

25th.—Large number of Swifts arrived at Etterby Scaur, on the Eden. Two were seen on the 24th, and one on the 23rd (D. Losh Thorpe). Tree-Pipit heard and seen at Leegate (R. Mann). Cuckoo heard at Head's Nook (G. B. Routledge).

26th.—Cuckoo heard at Knowefield, Carlisle (L. E. Hope). Cuckoo heard at Troutbeck, Windermere (W. E. B. Dunlop). Cuckoos numerous at Leegate (R. Mann). Corn-Crake heard at Leegate (R. Mann).

27th.—Large flock of Fieldfares at Crosby-on-Eden (E. Hodgson). Grasshopper-Warbler heard at Leegate (R. Mann).

28th.—Whitethroat seen at Troutbeck, Windermere (W. E. B. Dunlop).

29th.—Corn-Crake heard at Head's Nook (G. B. Routledge).

May 1st.—Cuckoo seen at Curthwaite (Ernest Carr).

2nd.—Cuckoo heard at Crosby-on-Eden (E. Hodgson). Some Common Terns seen, and first Lesser Terns arrived on the Solway to-day (W. Nichol).

3rd.—Pied Flycatcher seen at Brathay, Windermere (Rev. T. H. Baines).

4th.—Whinchat seen at Leegate (R. Mann).

5th.—Spotted Flycatchers seen at Annan (Major S. Ferguson).

13th. — Willow-Warbler's nest at Cotehill has five eggs (W. H. Little).

16th.—Pair of Shovelers seen near Silloth (W. Nichol). A Golden Oriole was picked up dead at Brathay, Windermere. It is the first record of this bird for Westmorland. Six degrees of frost the previous night had evidently been too much for this delicate southern bird. It was a young male in the plumage of the second year (Rev. T. H. Baines).

17th.—Young Ravens have left a nest to-day near Windermere (W. E. B. Dunlop).

18th.—Found first Lesser Tern's egg to-day, Solway (W. Nichol).

19th.—Saw two Red-breasted Mergansers near Silloth (W. Nichol). Hedgehog seen devouring young Thrushes in nest, Silloth (T. Nichol).

20th.—Fawn-coloured variety of Starling picked up at Hayton by T. W. Watson, Esq.; sent to the museum by H. S. Cartmel.

June 3rd.—Two Curlew-Sandpipers in summer dress seen on Easton Marsh, Drumburgh (Major S. Ferguson).

21st.—First young Swallow seen on the wing to-day at Leegate (R. Mann).

27th.—Cuckoo heard (last date) near Carlisle (L. E. Hope).

28th.—Common Tern's nest, with eggs, on Solway (W. Nichol).

July 8th.—Common Terns extremely numerous at Raven-glass this year. On this date many of the young had hatched; we marked a number of these chicks by placing an aluminium ring on their legs. The Sandwich Terns here have increased greatly, owing to the strict protection afforded them. In 1889 there were six eggs of this species laid there; this year there were over four hundred (L. E. Hope).

12th.—Nine Bar-tailed Godwits in summer dress near Silloth (W. Nichol). A young Jackdaw in brown plumage, a variety, seen at Leegate. An old bird of the same variety seen several times previously (R. Mann).

August 2nd.—A Willow-Warbler's nest at Windermere contained three half-fledged young (W. E. B. Dunlop).

6th.—A Hawfinch in nest dress was picked up dead at Skirsgill, near Penrith (H. Gandy).

8th.—A Spotted Flycatcher sitting on eggs at this date at Ivegill, near Carlisle. These were subsequently reared, a late brood (Rev. C. T. Phillips).

12th.—A Willow-Warbler singing to-day near Windermere (W. E. B. Dunlop).

13th.—A young Buzzard left the eyrie to-day; very late (W. E. B. Dunlop).

14th.—A male Garganey Duck in eclipse shot on Solway (T. Peal).

18th.—Slowworm caught at Aspatria (H. Thompson).

27th.—Little Stint seen at Silloth (W. Nichol). A Barn-Owl seen in Carlisle (T. L. Johnston).

30th.—Black-tailed Godwit and a Greenshank near Silloth (W. Nichol).

September 2nd.—A Barn-Owl's nest with two young seen to-day, Carlisle (T. L. Johnston).

7th.—About twelve hundred Bar-tailed Godwits seen on Solway (W. Nichol).

11th.—Flock of about forty Bean Geese on Solway (J. Backhouse).

12th.—Whitethroat last seen near Carlisle (L. E. Hope).

15th.—A Spotted Redshank seen near Silloth (W. Nichol).

21st.—Sand-Martins last seen near Windermere (W. E. B. Dunlop).

24th.—Willow-Warbler and Whitethroat last seen near Windermere (W. E. B. Dunlop).

27th.—Song-Thrush uttering fragments of song near Windermere (W. E. B. Dunlop).

29th.—A few Barnacle Geese arrived on the Solway (T. L. Johnston).

30th.—Wild Geese passing over Troutbeck Valley, Windermere (W. E. B. Dunlop).

October 2nd.—A Little Stint seen to-day, also a Peregrine Falcon, on the Solway (W. Nichol).

4th.—Swallows last seen at Windermere to-day (W. E. B. Dunlop). A Red-throated Diver, in summer dress, near Silloth (W. Nichol).

6th. — Saw last House-Martins to-day near Windermere (W. E. B. Dunlop).

8th. — Pair of Pintail Ducks seen to-day on Solway (W. Nichol).

10th. — Three Brent Geese seen on the Solway (W. Nichol).

17th. — Redwings seen for first time this season, Windermere (W. E. B. Dunlop).

19th. — Bramblings seen to-day near Windermere (W. E. B. Dunlop).

25th. — Skein of Wild Geese flying west over Stanwix (L. E. Hope).

27th. — Purple Sandpiper seen near Silloth (W. Nichol).

28th. — Fieldfares first seen to-day near Windermere (W. E. B. Dunlop). Great Crested Grebe shot on Solway (T. L. Johnston). Fourteen Grey Lag Geese seen on the Solway; also a second "gaggle" of twelve (W. Nichol).

November 2nd. — A Long-tailed Duck, an adult male in full winter dress, shot on the Solway near Gretna (J. Broatch).

3rd. — An immature Long-tailed Duck seen near Silloth (W. Nichol).

12th. — Pied variety of Fieldfare seen at High Head Castle, near Carlisle (J. B. Cairns).

13th. — Fifteen Grey Lag Geese seen near Silloth; about sixty Pink-footed Geese at same time (W. Nichol).

17th. — A flock of Crossbills, including several old males in red dress at Windermere. They stayed during the winter (W. E. B. Dunlop). A Red-breasted Merganser on the Solway to-day (W. Nichol).

26th. — Twelve Grey Lag Geese near Silloth (W. Nichol).

28th. — A Bat (Pipistrelle) flying to-day near Windermere (W. E. B. Dunlop).

December 17th. — Small parties of two and four Brent Geese on the Solway to-day (W. Nichol). Four Brent Geese seen on the estuary of the River Wampool (T. Hutchinson).

21st. — Purple Sandpiper seen near Silloth (W. Nichol).

24th. — Four Whooper Swans arrived on the River Eden at Carlisle, one being the bird which has paid us annual visits since 1904. They are all adult birds, possibly two pairs. This occurrence is one of the most extraordinary things in the whole annals of British ornithology. Their arrival was reported by the park keeper (T. Hudson).

THE DRAGONFLIES OF SOUTH-WEST SURREY.

BY GORDON DALGLIESH.

LIBELLULIDÆ.

Libellula quadrimaculata (Linn.).—This species I found in considerable numbers in the parish of Thursley on a tract of moorland known as Pudmoor, and I have never met with it elsewhere in the surrounding country. During oviposition the female constantly dips on the surface of the water and jerks her abdomen under the water. Dragonflies, with perhaps one or two exceptions, are essentially creatures of the sun, especially the present species. About the middle of June (1909) I visited the spot where I had seen these dragonflies the previous year. The early morning had been cloudy with fitful breaks of sunshine. When I arrived heavy clouds obscured the sun, and I walked to and fro over the ground searching for *Libellula quadrimaculata* in vain; not one was to be seen. I was just giving up the search as useless when out came the sun. Five minutes after the whole place was alive with these Dragonflies, and I can only suppose that previous to this they must have been resting on the rushes in the centre of a large pond. Their flight, like all the *Libellulidæ*, is swift, but does not exceed that of *L. depressa*.

Libellula depressa (Linn.).—Extremely abundant everywhere. There is hardly a pond, however small, that is not frequented by one or more of these lovely insects. Males, I have found, greatly exceed the females in number. Here, at any rate, it is never found far from water. I know of no insect that can rival this in powers of flight, and the only way to capture a specimen is to wait one's chance patiently, and strike quickly with the net the moment it finishes its dashing flight and is hovering. It is almost useless to attempt to catch it unawares when at rest, for, like the proverbial weasel, it seems to sleep with "one eye open."

Orthetrum cœrulescens (Fabr.).—This is decidedly a rare species here, and hitherto I have only been able to take it twice, once by Frensham great pond and on Pudmoor.

Sympetrum vulgatum (Linn.).—Frequently to be seen on the sandy paths that run through the pine woods. It is one of the species that seem to prefer shade to sun.

Cordulia aenea (Linn.).—This Dragonfly I found in large numbers over a pond in Thursley. Its flight is extremely swift; nevertheless, it is comparatively easy to catch any number of them. I found that it had a regular route of flight, and would keep flying round and round the edge of the pond. By waiting quietly at a certain spot for it to come round, and striking just at the right moment, I secured as many specimens as I wanted. If missed, it does not return to the attack so characteristic of *L. depressa*, but dashes off high up in the air, only to return to its given route after a few minutes. It rarely settles like *depressa*, but appears to be on the wing the whole day. I once saw numbers of the small *Agrion puella* chase this species, making repeated dashes at it as it hovered for a few seconds.

ÆSCHNIDÆ.

Both the *Æschna grandis* (Linn.) and *Æ. cyanea* (Müll.) are extremely abundant, and I have seen either one or the other on the wing as late as the middle of October. Locally they are known as “horse-stingers.”

CALOPTERYGIDÆ.

Calopteryx virgo (Linn.).—This species, to my mind, is the loveliest of all British insects, and I cannot conceive a sight more pleasing than to see a group of them hovering over the middle of a stream, and in their dancing flight putting one very forcibly in mind of gnats; for they look very much like large azure gnats. The habit of remaining in one particular spot is remarkable, and I have seen one return to a particular twig to rest times out of number. They have a decided preference for running water, and, unlike most Dragonflies, prefer shade to sun. Where thick trees and a tangle of brambles or bushes overhang swift running shallow water, one is pretty certain of

meeting with the graceful "Demoiselle." I have on two occasions, however, taken it a long way from any water. *Virgo* is subject to a considerable amount of variation. The female, as a rule, has a white stigma on the fore wing, but frequently this is absent altogether. The wings of the male are a deep shining blue, and I once took a specimen with the left fore wing almost white, though the others were of the normal colour. This Dragonfly generally puts in a first appearance the time the May-fly is "up." This and the next species are the only British Dragonflies that retain their brilliant lustre when dead.

Calopteryx splendens (Harr.).—Unlike the last, this is usually to be found either flying over or resting on the rushes bordering still water. I have not found it nearly so common as the last.

AGRIONIDÆ.

Erythromma najas (Hans.).—This I have found the rarest of Surrey Odonata, and have only taken it twice.

Pyrrhosoma nymphula (Sulz.).—When depositing its ova, this Dragonfly alights boldly on the surface of the water and remains thus motionless with outspread wings for some time. Occasionally it is accompanied by the male insect. I have found the under side of the thorax in this species often covered with a parasitic mite resembling those common on the Dor Beetle.

Lestes sponsa (Hans.), *Agrion puella* (Linn.), *A. pulchellum* (Lind.), and *Ischnura elegans* (Lind.), are all very common, frequently being found consorting together.

The above list must in no way be considered a complete one of Surrey Dragonflies. Doubtless there are many others to be added, but so far I have not been fortunate enough to come across them.

If the wing of a Dragonfly be examined under a microscope with a one-sixth objective, the nervures will be found to be covered with curious protuberances resembling thorns (cf. 'Zoologist,' 1908, pp. 458-9). I have often wondered as to what could be the use of these "thorns," and at one time thought they might act as a stiff support to the more delicate

portions of the wing,* and as an additional strength, helping the Dragonfly to sustain its powerful flight. But this theory has been considerably weakened owing to the fact that this thorn structure is to be found on the wings of *Agrionidæ*, *Calopterygideæ*, whose powers of flight are weak, and even the fragile *Ephemeridæ*. So for the present its use must remain a doubtful question.

Wishing to dissect the larva of a *Libellula*, to kill it I plunged it into water at nearly boiling-point and left it immersed for half a minute. When taken out, it recovered after a short time and became as lively as ever. If the abdomen of a dead *Libellula* larva be slightly pressed, the "mask" shoots out automatically.

* Cf. "The Adaptions of Aquatic Insects to their Environments," by Gordon Dalglish. 'Journal of the Bombay Natural History Society,' November 15th, 1909.

NOTES AND QUERIES.

MAMMALIA.

Common Shrew in Islay.—In his "Notes on the Mammals of Islay," published in 'The Zoologist' (*ante*, p. 113), Mr. Harold Russell records the capture of the Common Shrew (*Sorex araneus*) there in 1909, under the impression that the species has not previously been identified from the island. Perhaps, therefore, I may be allowed to draw attention to my record in the 'Annals of Scottish Natural History' for April, 1905 (p. 116) of one caught in Islay the previous year, which has escaped Mr. Russell's notice. — WILLIAM EVANS (Morningside Park, Edinburgh).

AVES.

Nesting of the Wren.—Mr. S. G. Cummings's instance of a Wren's nest which was built in March, left unlined, and not containing eggs until June (*ante*, p. 159), reminds me of a very similar experience here two years ago. In the middle of April a Wren was watched busily constructing a nest under the roots of a tree overhanging the bank of a burn. A month later (May 14th) a bird was flushed from this nest, which was found to contain an incomplete clutch of eggs. What interested me particularly in this case, however, was that the builder was a male, and the nest, when left in April, was a typical "cock's nest." The bird's sex was sufficiently attested by the frequent merry song with which he beguiled his labours. Was Mr. Cummings's nest also built by a male bird? To my mind it has never been satisfactorily shown that the *purpose* of the "cock's nests" is to afford roosting quarters for the grown-up young, although that is no doubt frequently the *result*. Sometimes the original nursery continues to be used as a dormitory after the nesting season is long over, as was the case in an instance last year, when a nest in which a family was reared in late July was still occupied nightly by several birds up to the end of November, and perhaps later. — S. E. BROCK (Kirkliston, West Lothian).

Avocets in Norfolk.—The three Avocets which were mentioned as having been seen on Breydon mud-flats by the watcher there on July 8th, 1909 (*ante*, p. 130), probably went to Blakeney—which is seventeen miles distant by the shore—when driven off by the high tide, for three were seen at that place on the same day, as I learn

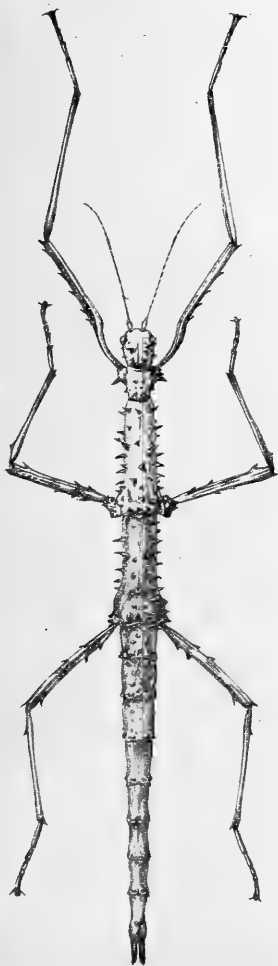
from Mr. Quintin Gurney. They were not molested at either place, and I have no doubt passed on.

May I correct some mistakes I passed in my recent "Ornithological Report for Norfolk"? On page 128, line 30, the word "France" should be added; on page 131, line 13 from bottom, "Rossitton" should be "Rossitten," the ornithological migration station in the Baltic; and on page 123, "Farmer" should be "Farman."—J. H. GURNEY (Keswick Hall, Norwich).

INSECTA.

An Undetermined Species of Stick-Insect found in Devonshire.

—A short time ago Mrs. M. F. Arbuthnot, of Fairlawn, Paignton, Devon, sent to the Natural History Museum a species of the group *Phasmidæ*, which had been found in her garden on a climbing rose. She added: "A winged one found has escaped." The winged insect probably had no connection with the specimen before me, as the latter apparently belongs to the apterous genus *Macracantha*, and is possibly the female of the true *Bacillus geisovii* of Kaup (Trans. Zool. Soc. 1866, p. 578), from New Zealand, which is certainly distinct from the insect described by Hutton under that name, and subsequently re-named by him *Acanthoderus suteri*. The synonymy is given in my 'Synonymic Catalogue of Orthoptera' (vol. i. p. 340). See also Brunner von Wattenwyl and J. Redtenbacher, 'Die Insekten familie der Phasmiden' (pp. 238, 239), who also write the two species under the name of *Acanthoderus geisovii*. There is a defective specimen of another closely allied species



in the Natural History Museum from Stewart Island, apparently distinct from any of those recognized by Hutton.—W. F. KIRBY.

Notes from South-west Hants.—In this neighbourhood the summer of 1909 will be long remembered as a very disappointing period in the pursuit of natural history objects, especially entomological; and the winter following was none the less uncertain from an ornithological point of view. The cold nights in July were very much against the success of the moth collector, and most of the generally common species of butterflies were restricted in numbers, except perhaps the two whites—*P. brassicæ* and *P. rapæ*—the larvæ of which were all too common upon the cabbage tribe, entirely destroying the crop in some localities. Again, the past winter has been somewhat abnormal both in weather and temperature; Bats abroad in January, Blackbird singing, and eggs and young Thrushes in February are not of frequent occurrence even in our uncertain climate. Referring to the spring of 1909, we find the Swifts put in an appearance in very strong force and unusually early, but later in the season scores perished with the cold. Other members of the Swallow tribe were not so abundant as usual, but a comparatively good number of the Nightjars were to be seen and heard of an evening, and I am glad to say at the same time the welcome “crake” of the Land-Rail was occasionally detected; although once so common, this strange note had been very scarce, if not entirely wanting hereabouts, of late years. Of the other summer visitors, a fair sprinkling occurred—all except the Nightingale, whose notes were much more scarce than usual; some three summers ago the birds sang and might have nested in some of the gardens close to Ringwood. Early in June the migrating Hobby was not rare: I knew of three being slaughtered within a fortnight, and possibly a pair nested in a certain wood, as they frequented the same locality throughout the summer, and yet I did not hear of any following the Swallows, as they often do in their autumn migration. That the Shoveler also bred in the valley of the Avon I have no doubt, as the description of Ducks occasionally brought to me during the summer could apply to none other than the male Shoveler, and as a more conclusive proof quite young birds were seen by one of the river keepers, who also saw young Teal upon the water. Of course, it is not the first time either species has nested in the locality, but it is interesting to know they still do so, if rarely. The Redshank still continues to visit us, perhaps in increasing numbers, and nests in localities where a few years ago it was a stranger, its eggs being often sold as those

of the Peewit; large flocks of the latter bird were seen passing to and fro, but fewer nests than usual were found, and throughout the summer and autumn I heard of but one Peregrine Falcon preying upon the Plovers at any time, which was not the case in former years. As the winter advanced, a large number of Golden Plover were seen at times frequenting the same locality as the Peewits, but their stay was not prolonged—possibly the flooded meadows were not agreeable to them—and if settling upon a favoured spot in company with or near their crested relatives, the two species invariably separated on rising and flew in opposite directions.

At the end of September an immature female of the Honey Buzzard was killed. It was in dark plumage, various shades of brown predominating, especially upon its long and beautiful tail. Its stomach was quite empty and body scantily nourished, but its plumage was clean and bright, and not in the condition one often sees in a lean, semi-starved creature. The river being in flood most of the winter the conditions were unfavourable both for gun and rod. Teal were scarce, and Wigeon only in fair quantity; Snipe were often abundant, but no extraordinary “bags” were made, and, although a goodly number of Mallard were upon the water, only a few Pochard, Tufted Duck, and Shovelers were seen or shot; whilst such species as Gadwall, Goldeneye, Goosander, &c., were very rare or altogether wanting. Indeed, on some parts of the river the wildfowl shooting was almost abandoned, not so much from the recognized paucity of birds as from the difficulty of getting near them, and in one sense this was fortunate, as the mild open weather had induced many of the Duck tribe to show signs of the coming duty of nesting—by frequent squabbles amongst themselves, and *pairs* rising and flying around the noisy group below—and it seems the height of folly when creatures are killed at such a time. Unlike the reported abundance of Wild Geese upon the east coast and in some parts of Ireland, very few visited us, and were seen during two or three of the milder days at the beginning of February flying over the inundated meadows, but they soon disappeared, and were not seen again when the waters had somewhat abated, and the weather was much more severe.

Several Bitterns frequented the same locality, and one if not two were killed at distant points; but now more than formerly a better state of feeling for the protection of this beautiful and interesting species seems to prevail in many quarters, and quite rightly too, as often the birds were killed just for the sake of “killing something”; and the same remark may be applied, with the same or greater force,

to the most lovely of all our birds, *viz.* the Kingfisher, which I am glad to say has increased considerably during the past few years. It is also interesting to know that a heronry in the neighbourhood is still flourishing, notwithstanding the persecution accorded the grand old birds if they wander far from their protected home. As to the smaller winter visitors, I did not hear much of either Siskins or Lesser Redpolls, but Bramblings and Crossbills were conspicuous at times in suitable localities, the former foraging amongst the "beech-mast," and the latter favouring the "conifers"; both species are rather uncertain in their visits, but generally occur in greater or lesser numbers, the past winter being especially favourable, and yet I have known of very few being shot; in fact, the only one was a specimen a man described as "a red bird with a deformed bill, crossed like the 'nippers' we formerly used for holding Eels."

The river having overflowed its banks so often, the angling successes have been few and far between. As usual, some fine Roach and Perch were taken, and large Chub were to be had; but at the opening of the Salmon season in February no fish was taken in the upper parts of the river for several weeks, and very few since have fallen to the lot of the most expert angler. I was told that a very fair number ascended for spawning in November and December, but few "fresh run" fish seem to have come very far up the stream for the present; perhaps when the "prawn" bait is used in May things will be more promising. Several large Pike, ranging from 20 lb. and upwards, were taken, and one angler told me he caught ten in one day, the largest—which I saw—weighing 22 lb., and the next in weight 18 lb., the rest were smaller, ranging from 3 lb. to 6 lb each.—G. B. CORBIN (Ringwood).

P.S.—Two fine female Badgers were captured, at the end of March, in a locality where only Foxes were suspected, and several of the cream-coloured variety of the Mole have been met with, but I have not heard of or seen a Stoat in white or dappled coat the whole season.—G. B. C.

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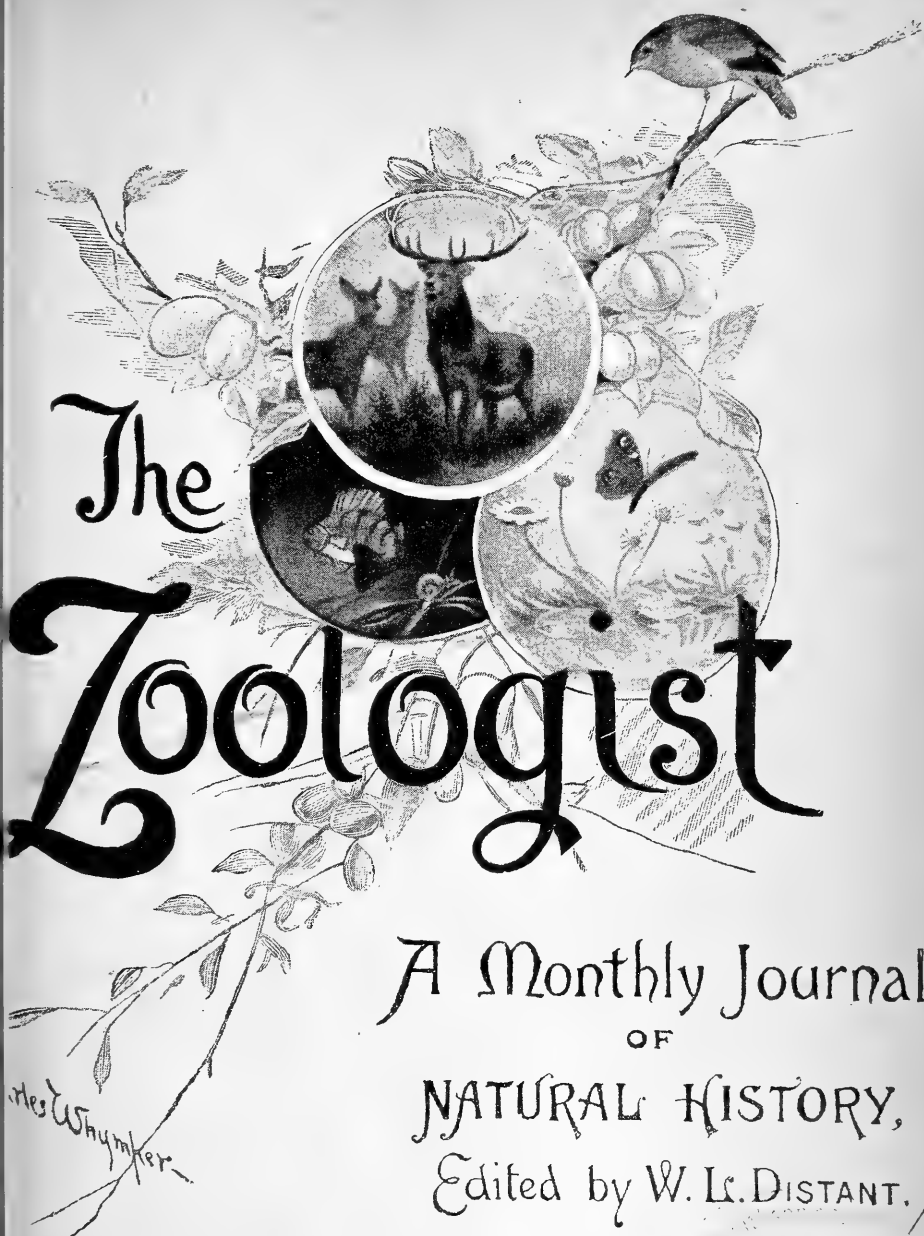
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THE MECHANISM OF PLUMAGE IN WATER BIRDS.

BY FREDERICK J. STUBBS.

MOST observers are familiar with the power of certain birds to alter the degree of their submergence in the water. It is many years since the question was first discussed—by Atkinson and Slaney in the second volume of 'The Zoologist,' and by Beverley Morris in the first volume of his 'Naturalist.' Since then other writers have published their views, without adding anything to our knowledge, and the mystery is as deep to-day as it was sixty years ago; so no apology seems necessary for this further attempt to solve the puzzle.

At times the Moorhen—as I have myself frequently observed—and almost certainly the Grebes, hold themselves beneath water by grasping the stems of aquatic plants. It has been denied that the Grebe has the power to so use its toes, but I have several times seen this bird disappear from sight, and remain hidden, under circumstances leaving no room for doubt that the bird was keeping itself beneath the surface by clinging to the vegetation, as a Moorhen will do. Before we state that a Grebe cannot use its toes for grasping, we must consider the structure of a bird's foot, and the way it is used in the case of the Moorhen and other birds. Owing to the form of the joint between the proximal phalanges and the tarso-metatarsus, the outer digits, when the foot is closed, press in laterally towards the

centre. The flexion of the toes is thus quite capable of providing sufficient lateral power to grasp small objects placed in the extreme angle. It is easily tested in a dead bird, and freely used by the Moorhen and its relatives when feeding on such substances as maize. Sometimes the hallux is used as a supplement, but generally the grain is held tight either between the second and third or the third and fourth digits. This is by the way; I mention it because the point has escaped notice, and the knowledge may be useful in a study of the Grebes beneath water.

Yet it often happens that a bird, from a position indicative of extreme buoyancy, will on alarm sink in the water until only the top of the back and the head and neck are visible, and this at times when the aid of such things as plants is out of the question. In fact, with the birds of the genus *Colymbus*, grasping is anatomically impossible, even did the foothold exist. The Red-throated Diver, on occasion, swims as high in the water as a Mallard; yet when alarmed it will sink until almost all the body is below the surface. This is true, to a certain extent, of all swimming birds. Even the surface-feeding Ducks (as Slaney noticed) are able to submerge their bodies to an extraordinary extent.

Without any further notice of facts that are common knowledge, an attempt can be made to solve the problem. It is merely a question of specific gravity, and the methods by which this is at the will of the bird. Gätke, in a well-known paper, attempted to deal with the matter this way, but his essay was not a happy one. For one thing, he guessed the bulk of a Great Northern Diver to be about one cubic foot! He knew the weight of a foot of North Sea water to be sixty pounds, and a very little trouble would have shown him that the bulk of a big Great Northern Diver was not the third of a foot.

I am enabled to give the exact bulk of a few typical water birds. The cubic content of a Black-necked Grebe weighing ten ounces was 25.3 in.—roughly speaking, the sixtieth part of a foot. A Little Grebe of six ounces had a bulk of 13 in.; a Smew of fifteen ounces, 35 in.; a Mallard of two pounds, 198 in. All these calculations were made on clean dry birds, with the "feather film"—to coin a convenient term—unbroken. Students

of physics will remember that the surface-film of water is appreciably tenacious, and is with difficulty broken by a fine-meshed fabric. The water-repelling property of the plumage of such a bird as a Duck is attributed to the grease or oil on the feathers. This I find to be by no means always the case; the grease must play a very minor part indeed in the work of keeping the feathers dry. The experiment of washing the feathers of a Duck in warm soda water, and afterwards with benzine, so that all trace of oil is removed, proves that the power lies in the actual structure of the feathers. The parts employed are the cilia and barbicels normally, the modified barbules frequently, and the hamuli (when present on the contour feathers) also frequently. I may be allowed to point out that this use of these feather elements has not before been noticed; and I think that without their aid existence under present conditions would be impossible to most birds.

I have termed this outer mesh of barbules, and the pile of cilia, the "feather film." It is hardly correct to say that when a bird gets wet the water penetrates the feathers; as a matter of fact, it is the other way about—the feathers penetrate the water! As long as the tough surface-film of the water remains intact, the feathers will remain dry, and the fine pile of the cilia and barbicels, only to be detected by the microscope, keeps the water from the coarse touch of the harder parts of the feathers.

Between this "feather film" and the skin of the bird there is a thick layer of air, varying in quantity according to circumstances. In a clean and dry Black-necked Grebe I ascertained it to be 4·8 cubic inches. In life this aerial envelope could have been considerably increased at will. Each of the contour feathers is provided with a separate apparatus of muscles, whereby it can be held out at right angles or pressed close to the body. In the first case the bird would appear round and fat, in the second very slim, and there would be a corresponding change in the extent of the air-envelope, and consequently of the buoyancy of the bird. By adjusting the thickness of this layer of air between the "feather film" and the epidermis the bird can alter its specific gravity; and here, I think, we have the answer to the riddle.

I have made a great number of careful observations, calculations, and experiments on various species of birds, but I hardly think it necessary to take more than a single instance, and that the Little Grebe. The Lathkill and several other of the neighbouring Derbyshire streams provided admirable conditions for making the necessary observations, and for checking the experiences of other districts. When a family party dozing in the middle of a pool was alarmed, they all disappeared below the surface and remained submerged, with the exception of their heads or bills. I was not able to be sure how they held themselves below the water, but see no reason to doubt that use was being made of the rank vegetation—probably by the inward pressure of the flexed toes, as I have described. Yet this detail is not of great importance.

In time, if reassured by the stillness of the intruder, the Grebes would appear again, but very gently and unobtrusively, and in a while they would take up their positions at the surface, perhaps in the centre of the pool, away from the vegetation. It was easy to watch the slow transition from a state of total submergence—so far as the body was concerned—to one where the birds floated, balls of feathers, high on the water. Those familiar with Grebes (or almost any other species of water birds) must have noticed this occasional habit of floating nearly as lightly as a Gull.

At each distant alarming sound the Little Grebes would drop suddenly deeper in the water, the degree in the change of draught varying with the source of the alarm; and when danger seemed imminent, and the birds dived, a preliminary drop in the water indicated a sudden change in the specific gravity. The Moorhen acts in the same way when alarmed, but this instinctive feather adjustment, for another purpose, however, is seen most prettily in its relative, the Water-Rail; at each forward step, if only for a couple of inches, the flank-feathers are automatically pressed close to the sides, so that a cross section of the body would give not a circle but a long oval. This is connected with the Rail's miraculous facility for passing rapidly through tangled herbage.

The following results of experiments and calculations made on a freshly killed Little Grebe support the conclusions based on

those made with other birds. The absolute specific gravity of this specimen was .86. While dry and clean, with plumage unruffled, and the aerial envelope kept as large as possible, it was .66, and with the feathers carefully bound down with fine yarn in as natural a manner as possible it was .84. The actual loss of bulk between the two conditions—with feathers held out and with them depressed—was 2.24 cubic inches. Of course, the whole of this air is not available for lifting the bird in the water, but I see no way of measuring the exact amount of the effective air, and must be allowed to guess that at least one full inch can be used. The increase in buoyancy due to the addition of one cubic inch of air to a body six ounces in weight must be very considerable, and quite enough to cause the alterations in draught that we observe in the living bird.

Some observers have thought that the air-sacs play a part in the submergence of water birds. I cannot think this is so. In a dead bird the amount of air in these rarely examined reservoirs is very small, as may be seen by opening them under water, and the structure of the body prevents the bird increasing this quantity to any useful extent; and, it will be remembered, the volume of air would bear but a small proportion to that of the aerial envelope outside the epidermis and within the "feather film." Observations seem to show that the syrinx of a Little Grebe is too small to allow the escape of a sufficient quantity of air to cause the sudden difference of draught in the alarmed bird.

There are many minor points that will be noticed by a thoughtful observer, but I do not think it is necessary to detail them here. An alarmed bird lifts its heavy head and neck right out of the water, thus destroying the large reservoir of air round the crook of the neck, and throwing additional weight on the floating body—just as an uplifted arm will press a swimmer deeper in the water. The actual shape of the bird is also important, but I am sorry to say that I have not been able to make any reliable experiments. When a diving Duck is standing on the land (a Pochard was an excellent example) it exhibits a broad and flat keel, and is obviously farther through from side to side than when it is diving. This is an important

item, for a flat-bottomed vessel floats higher than one of the same weight with a deep and narrow body. Of course, the Duck can alter the outward shape of its waterproof "feather film" at will.

I offer the above remarks as an attempt to solve a problem that has for long puzzled ornithologists. I have explained how a Grebe may use its clumsy toes, and how a Moorhen actually does use them; indicated the use of the cilia and other feather elements in keeping the plumages of *all* birds waterproof, and showed that this power is not dependent on the grease. Finally, I point out how the actual submergence of a swimming or floating bird is due to the height of its specific gravity, and how this is readily adjusted within the necessary limits by the voluntary act of the bird.

NOTES ON THE BREEDING OF THE GREAT TIT (*PARUS MAJOR*, LINN.).

BY C. KINGSLEY SIDDALL.

THE usual time for the breeding of the Great Tit is from the middle of April onwards. The pair under notice commenced to build on the last day of April in a box which had been placed for the purpose in an apple-tree.

The nest was a typical one, composed of moss and a good deal of red wool which had evidently been torn from an old mat. It was warmly lined with wool and hair. Both birds took part in building, and finished the nest on May 4th. The first egg was laid on May 5th, and on the 12th the female began to sit on a clutch of seven. She sat extremely closely, and often refused to move when the box was opened. This was done very frequently, in the hope of finding the male bird sitting. He was never discovered doing so, and, indeed, visited the nest seldom in the daytime during incubation, though he always roosted in the box at night. He was not observed to carry food to the sitting female during this period.

Some days before the young were hatched, a camera was placed in position, with the result that the Great Tits became accustomed to the sight of it, and photography (with a twenty-foot shutter release) became a fairly easy matter. A hiding-place was arranged, eighteen feet from the camera, from which the exposures could be controlled, and with a pair of binoculars any known species of larvæ could be readily recognized when the parents came to the nest.

On May 24th seven young birds were safely hatched; in appearance excessively ugly, the only covering on their otherwise naked skins being a suspicion of down on their skulls and shoulders. The legs and claws looked much too strong for the rest of their bodies.

On the fourth day there was down on the dorsal tract, and signs on the wings of the coming pen-feathers. On the sixth day the bluish tinge was noticeable. The tail-feathers could not

be seen until the tenth day. The first nestlings had their eyes open on the eleventh day.

On the fifteenth day a curious incident occurred—the female laid an egg on the young birds! When twenty-one days old the nestlings were fully feathered, and two days later they left the nest.

On leaving the box the old birds usually carried out the faeces of the young, and dropped them a short distance away; apparently the faeces were never swallowed by the parents. It is an interesting point to observe that, although the nest is kept



YOUNG GREAT TITS, TWENTY-TWO DAYS OLD.

clean in this way, it is very full of vermin. Why do these insect-eating birds leave these untouched? The food carried in to the nestlings consisted almost exclusively of small moth larvæ.

About thirty yards from the nest there was a small spindle-tree, which was at this time literally covered by the larvæ of the Small Ermine Moth (*Yponomeuta padella*). For the first sixteen days the Great Tits made no attempt to take these caterpillars. Probably they were afraid of the web-like material which surrounds the larvæ of this species.

On the seventeenth day the male bird was seen to be carrying a grub which had not previously been observed. The camera-shutter was released with a crash as he was about to enter the box, and in his fright he dropped the caterpillar, which on examination proved to be that of the Ermine Moth. Having found they could take them with impunity, the Great Tits made short work of these garden-pests, for, until the young left the nest, the birds went backwards and forwards constantly between the spindle-tree and the box. On counting they were often found to be paying four visits in five minutes. Frequently the female would arrive with food before the male bird had left the box, and *vice versa*.

An interesting difference in the behaviour of the sexes was noted. The male bird invariably used the perch in front of the box before entering. He would cling to it with his claws, while he looked from side to side. In this position he was easy to photograph. The female never used the perch; she would alight on a branch in front of and a little above the box, and would drop right in, merely touching the edge of the hole with her feet as she entered. Several plates were exposed with the same result, a view of her feet and tail being obtained each time. Apparently it was not nervousness which accounted for this, as the bough of the apple-tree she used to alight on was barely two feet from the camera.

The larvæ of the following insects were taken as food:—Small Ermine Moth (*Yponomeuta padella*), Winter Moth (*Cheimatobia brumata*), Magpie Moth (*Abraxas grossulariata*), Cabbage Moth (*Barathra brassicæ*), Sawfly sp. (*Nematus ribesii*). There were three nests of Humble Bees (*Bombus* sp.) close at hand, but the Great Tits made no attempt to take the bees. There is no doubt that the birds will take any small larvæ as food, and the species mentioned above happened to be the commonest available near the nest.

The Great Tits undoubtedly do much more good than harm in an orchard or garden; the foregoing short list is composed entirely of injurious insects, and the Small Ermine Moth in particular is a most destructive species. It is rather curious to note that no beetles or flies were taken, the explanation probably being that more palatable food was plentiful.

On June 17th the young birds left the nest. It will be thus seen that five days were spent by the old birds in building the nest, seven in laying, twelve in incubation, and twenty-three in rearing the young. Contrary to expectation, the Great Tits did not use the box for roosting at night after the nestlings left it.

On the day of flight the seven young were seen at intervals following the parent birds from tree to tree. Food was still carried to them, and it was a pretty sight to see them feed. On June 21st two adults and five young Great Tits were seen, close to the box, searching for food in the fruit-trees, and now the young were making efforts to find their own food.

On June 26th the same numbers, and almost certainly the same birds, were observed in the orchard, but after that date no *family* of Great Tits was seen in company, although numbers of young and adult birds were common through the summer. This would rather point to the breaking up of the Great Tit family much sooner after the nest is left than is the case with its relation, the Long-tailed Tit (*Acredula caudata*). Families of this species are known to keep together months after leaving the nest.

It is perhaps worthy of note that the eggs in this nest were left uncovered until the female began to sit; often the Great Tits cover their eggs with feathers or wool when leaving the nest, and continue to do so till the full clutch is laid and incubation begins.

THE FORMATION OF USELESS HABITS IN TWO
BRITISH NEWTS (*MOLGE CRISTATA*, LAUR.,
AND *M. PALMATA*, SCHNEID.), WITH OBSERVA-
TIONS ON THEIR GENERAL BEHAVIOUR.

BY BRUCE F. CUMMINGS.

(Concluded from p. 175.)

V.

My conclusions are :—

1. That Newts, in a labyrinth, rapidly acquire simple habits of movement. Plasticity is shown, for these rapidly acquired habits as rapidly disintegrate and become re-acquired, although the acquiring of a habit takes longer than its re-acquirement, after short intervals from about twenty minutes.

2. On account of the Newt's plasticity, a simple habit can be "forced" in a short space of time by frequency of stimulus.

3. The plasticity must again serve to account for the large number and elaboration of useless habits formed, from which no pleasurable result accrued.

4. A movement, once made, tends to be repeated. Apart from useless habits, I observed throughout how frequently quite insignificant and useless movements were carried out twice in succession, or sometimes three times.

5. Motor sensations are chiefly used in learning the labyrinth. It "feels" the direction in which to turn (and in which it has previously turned) through the effects of previous muscular sensations. Touch also helps, but sight only a little.

6. The strong "nosing" instinct or stereoscopic reflex can be partially inhibited, and a perfect habit temporarily formed.

I have given in the preceding pages some of the most interesting and the most typical examples of behaviour that I observed. All the other experiments with the rest of the Newts confirmed the conclusions above, but none of the animals, of course, succeeded in learning the more complicated mazes per-

fectly or permanently, for the same reason given for the others—nosing and climbing impulses.

VI.

It seems not improbable that the evolution of the capacity for habit formation has taken the following stages:—

1. Where there is no modifiability of behaviour.
2. Where modifiability does exist, but in only a slight degree, so that habits become formed only after a long period of "stamping in." On account of this protracted period of "stamping in," useless habits cannot be reduced, and therefore correct habits are not formed, although roundabout methods of solving the problems presented are adopted.
3. Where there is rapid modifiability, succeeded by a more or less rapid reduction of useless habits. The very fact of rapid modifiability makes reduction possible. But rapid modifiability, in its inception, consists of the tendency mechanically to repeat movements from which pleasure need not necessarily result. Thus a large number of useless habits would make their appearance, and the first solution of a problem would be a very roundabout one. Subsequent experience would reduce the number, and different animals, varying in intelligence, would vary in the rapidity with which they were reduced.
4. Where a keener consciousness and a more acute intelligence means rapid modifiability, but, more particularly, few useless habits, as only movements ending in pleasure would tend to be impressed on the nerve centres, and therefore to be repeated. The relative intelligence of different animals in this category would depend upon the rapidity of their perceptions of those movements most conducive to pleasure, *i.e.* upon the paucity of useless habits formed in the first instance.

5. Where, finally, modifiability is more or less immediate, through the presence of the memory idea, absent in the others.

The first class is perhaps hypothetical, perhaps the Crab belongs to the second, while the third class is represented by the Newt, the fourth by the Pigeon, and the last by Man. All these animals have had their learning powers tested. This course of development would involve the formation of useless habits, not as a freak of intelligence, but as a natural sequence in the order of

things. In an animal with a low intelligence, such as the Newt, useless habits are very clearly demonstrated by the labyrinth method, where, on account of the Newt's plasticity, movements tend to be repeated; useless habits are thus formed, and the first solution of a labyrinth problem is a roundabout one. But there is also reduction—the complement of rapid modifiability—so that this animal, which has such blunt perceptions, is able by a process of mechanically building up and then cutting down to form a more or less perfect habit.

The examples of useless habits which I have given were all extraordinary, and were described in order to show that there does exist mechanical repetition of useless movements.

Prof. M. F. Washburn records* that in the case of some Salamanders tested by her in a labyrinth, the animals never learnt the maze properly, but formed many elaborately useless habits. The motive employed was not satisfactory, and the experiments were not therefore completed. It is, however, interesting to note that the appearance of these elaborately useless habits have been corroborated by my experiments with Newts. Useless habits of a lesser degree have been also reported in other animals.

What conclusion is to be drawn from a consideration of the Newt's tendency to repeat movements is difficult to see. The observations made on the Newt, especially when in the spiral labyrinth, showed that movements undoubtedly tended to be repeated, irrespective of consequences. The animal went continuously right or continuously left of the pillar, though both were equally correct. It might be supposed, therefore, that the repetition of these turns is largely mechanical, and only very indirectly dependent upon conscious choice. If the Newt simply chose the directions leading to pleasure, it should on the average have gone alternately right and left of the pillar of the spiral. In other labyrinths many useless habits were formed which led only extremely indirectly to pleasure. It is possible that this tendency under certain conditions to repeat movements indiscriminately is mechanical. Such a mechanical tendency could be acquired if useful. Its usefulness to the animals when in a state of nature is quite inconceivable, and if mechanical,

* 'The Animal Mind,' p. 231.

the movements must therefore be repeated through some unknown and wholly adventitious nerve mechanism, which seems impossible. The explanation of useless habits as they occur in the Newt and other animals probably lies in the nervous inertia of these animals. They prefer, when hard pressed as in a labyrinth, to repeat an old movement rather than seek out new and more appropriate ones. We can observe not an exactly parallel but an analogous case where a man in a labyrinth, out of which he had not found the way, would, in wandering up and down the passages, form after a time little habits of movement that would save him mental exertion.

PART 2.

VII.

In attempting to form an opinion on the general psychology of the Newt, it is necessary to take into consideration the various chapters in the story of its life. There is one which stands out in particular, amid its general amphibian sluggishness, as proof of an unexpected amount of nervous activity stored up in the brain which only develops periodically—I mean its courtship displays in the spring. In the Palmate, for example, the male assiduously follows the female about, taking advantage of every opportunity to display. Its display attitude is well known—curved body, hollowed-out, cavernous side on the inside of the curve, and the rapidly vibrating tail and caudal filament. The whole aspect of the animal is one of extreme activity and nervous tension, which, occurring as it does in a Newt, is thoroughly surprising. This excitement expends itself along the easiest line by travelling into the tail, which is so easily swept from side to side, or vibrated. Most courtship displays can be explained in the same way as a matter of accident. In the case of the Great Crested Newt a gradation is found, leading up to that which obtains in the Palmate. The Great Crested does not bend the tail back flat along the side, and rapidly vibrate it; it merely waves the tail like a happy dog or an angry cat. Its excitement is less than the little Palmate's.

The handsome and distinguishing features of the male Palmate all lie along the sides of the body, one or the other of which is always turned towards the female during courtship displays. It

is a curious fact—to sexual selectionists a very useful one—which I do not think has been pointed out before, that—

1. The displays invariably take place at the front end of the body of the female Newt where she can see them.

2. The tail is invariably vibrated on the side which is facing the female. If, in the middle of a display, the female so moves as to be able to see only the other side, the male stops vibrating its tail, unbends it, and turns it round to the other side, where the vibrations are re-begun.

That the Newt possibly recognizes the female only by sight is shown by the following circumstances: I had in the same basin, with healthy males and females, two unhealthy males, which had developed only to a very slight degree the usual sexual adornments. In fact, they looked very much like females. On two occasions a male—a different one each time—came and displayed before these males, which they obviously mistook for females. As I shall emphasize later on, the frequency with which Newts are deceived by appearances is a marked feature. I have also watched ecstatic little males displaying to a female while the latter was in the act of laying an egg.

The female remains quite passive throughout; if she is willing to be fertilized, her willingness is indicated by a hypnotic stare; she remains motionless long enough for the male's excitement to reach its flood, when the spermatophore is dropped. Whether the motion of the tail has any fascination for the female it is difficult to say, but it is worth remembering that Newts are exceedingly quick to observe motion, and are often deluded into snapping at moving objects in mistake for food, while other motions they will watch attentively for minutes at a time. Whatever be the feelings of the female, no one can help being astonished at the abounding energy and enthusiasm of the little male. I have seen it, in a paroxysm of sexual excitement, bend and vibrate its tail, hollow out its body, and lift the whole of its hind quarters and legs off the ground, so that it assumed the appearance of standing on its head. There is no such behaviour in the Toad or the Frog to compare precisely with this, as the tetanic contraction of the muscles of the fore legs of the Toad on the abdomen of the female, if roughly equivalent in the amount of energy required, is not so spectacular as the Newt's

performances, and necessitates less mental activity and alertness.

VIII.

As to parental instinct, the Newts show a distinct advance on the Frog and the Toad. In the Palmate Newt the leaf of a water-plant is clasped by the hind feet of the female in the well-known way, and after the deposition of the egg the leaf is bent back and round the egg, and secured by a sticky gland secretion. Such a mode of egg-laying means that a less number of eggs can be laid, for, in the place of the mechanical reproduction of a large number of eggs, we have the careful concealment of a relatively few, *i. e.* reproductive activity is in part turned over into mental activity. It is shown on all hands by a study of comparative psychology that our system of zoological classification is even more arbitrary than there was any reason to expect. In placing the Bee, for example, in a position so far below the Newt, zoologists are only taking into consideration one or two morphological points, such as the occurrence in the Newt of a backbone and in the Bee of a tracheal system. Yet it must be admitted that from the wider standpoint of general but more particularly nervous organization the Bee, albeit on a different branch, stands as high on the Tree of Life as does the Newt. The convenience of our classification is very great, but it is apt to lend us a distorted view of the actual relations between different animals. Because man has a backbone, we are too disposed to think that any organism without one must be a "lower animal." The brain of the Newt can only be considered higher than that of the Bee in reference to its form, the mould in which it is cast.

IX.

An account of the mental characteristics of the Newt would be very incomplete which did not refer to its feeding habits and its astonishing voracity. As a rule a Newt will not eat a dead and motionless worm, not, I think, because it is dead, but because it is motionless. I made a few observations on the behaviour of some Great Crested Newts, when presented with some dummy worms made of putty. If the dummies be motionless at the bottom of the pan, no notice is ever taken of them. But if I took hold of the end of one by a forceps and waved it

about so as to imitate the motions of the worm, the attention of the Newts was immediately called to it. A large female accepted the dummy and the real worm in the following order :—Dummy, worm, dummy, worm, dummy, worm, dummy, dummy, worm, after which it refused dummy. The next day it went : dummy, worm, after which dummy was refused. After it had been offered dummy four more times it grew to take no interest in it, its motions not attracting its attention in any way. A real worm was then offered the animal, which it immediately seized with avidity. A dummy was then offered again, and it seized it quickly, but dropped it again, and after, although it went on accepting the worms, it continued to refuse the dummies.

The dummies were twice as big as the worms. The Newts paused longer before snapping at a dummy than they did before a worm, except in the above case, where it was quickly seized and as quickly dropped. This shows that the Newts are able to distinguish a difference between worms and dummies, but that they are sufficiently deceived by appearances to be induced eventually to snap and swallow. I found the same animals would follow about a piece of bent wire, and one of them even snapped at it, but this animal may have been *more than usually hungry*. One of my Cresteds, after living in one of my pans for six months, died of starvation, on account of an obstruction of the rectum, which, on dissection, was shown to be caused by a small quantity of earthy matter and seven caddis-worm cases, with remains of their putrefied occupants. The earthy matter was of the same material as the cases, and probably represented at least another caddis-worm case, making eight in all. The rectum was distended to bursting point, and the other organs displaced. The species of caddis-worm was a very common one in the pond when the Newt was taken, at which time it was first observed to be suffering from what I thought was a tumour.

This is easily explained if we bear in mind the Newt's readiness to snap at moving objects. Palmates are great adepts at snapping at almost microscopic organisms as they rush past. Another Newt, which I tried, drove me to the conclusion that either it was a mental wreck or else had developed a taste for

putty! It snapped and swallowed a small piece six times in succession, and snapped at it twice after, making eight in all, after which it refused the dummy, although taking the worm. The front legs are never used in feeding as in the Toad.

It is worth remarking that by some means or other the Newts in a pan of water, which have not themselves noticed the presence in the water of a worm, nevertheless frequently appear to realize it immediately, as soon as another Newt has seized the worm and given it the usual shake from side to side—a useful instinct which prevents the coiling of the worm around the Newt, and which is given also with dummies, but not with animals other than worms. A sense of taste very probably exists, as I have seen an empty Newt sometimes come up and place its lips against those of another which had just swallowed a worm, and afterwards show by its tendency to snap at its comrades that it knew there had been food about.

X.

A Newt, on arriving at the edge of a square board raised above the ground, as a rule stops and pauses before throwing itself over. I discovered that at heights of 180 centimetres and upwards the Great Crested generally refused to go over, after hanging over the edge and looking down to the ground beneath, which in all these experiments was covered with a dull brown cloth. Some animals would go over at any height, others would show great hesitation at the 180 centimetres, eventually slipping over—it was difficult to tell whether by accident or intentionally. If the Newts are in a hurry, or in a state of excitement, they rush off at any height. Similarly with three Newts which were extremely lethargic through hibernation. It is interesting to observe that in the case of fifteen *M. cristata*, which, in the beginning of September, were removed from water to a vivarium, the heights at which they would throw themselves over the edge of the board varied in inverse ratio as the length of time that they had been removed from the water. After being in the dry box for forty-eight hours, 60 centimetres was refused by nine to six. After ninety-six hours only two went over. On the fifth day five refused 6 centimetres. On the next day nine refused 15 centimetres, two refused it at the first trial (going over sub-

sequently), and only three went right over at the first time. Several days later I found that three of the Newts refused to leave the board, when it was placed on the floor of the room, so that the height was only the thickness of the board, *i. e.* 2 ctm. 2 mm. One of the three perceived the edge when a couple of centimetres away, and would draw back. However, when placed immediately after on a piece of cork matting only 8 mm. thick, they all three went over, but only after a pause of ten seconds in two of the cases and eight in the other! The rest refused a height of 15 ctm. by eight to two.

By experimenting with these Newts, when in this condition of refusing low heights, I thought to be able to discover whether they had any elementary power of judgment of height. The results showed that they can recognize extremely low heights (as might have been expected) up to between 5 and 8 ctm.

The Newts, in all the experiments, were tested singly and in series. Below are some of the best instances in which a Newt showed its disinclination to go over 180 ctm.

- Singly: 1. 60 ctm. refused after pause of 75 seconds.
 2. " " " 30 "
 3. 20 ctm. " " 30 "
 4. " went over " 18 "
 5. " " " 20 "
 6. " " " 10 "
 7. 60 ctm. " " 10 "
 8. 180 ctm. refused repeatedly, walking on the
 board for five minutes.
 9. 60 ctm. went over after a pause of 50 seconds.

This shows how easily previous behaviour influences the Newt, not, however, completely in the 180 ctm., although the pause at the next drop of 60 ctm. was increased. Another animal gave:—

1. 60 ctm., over after 30 seconds.
2. " " 20 "
3. 90 ctm., over immediately.
4. 180 " refused repeatedly.
5. 60 " over after 60 seconds.

[In series : 30 ctim., thirteen went over and five refused.

80 ,, eleven refused and five went over.

30 ,, eleven went over and six refused.

If the animal is able to judge when it is as high as 180 ctim., as the evidence points, it probably does so by sight. All the animals, if hesitating, spent their time in looking down and around. At 180 ctim., perhaps, they are able to see nothing at all beneath them. In the middle distances they can see the floor, and therefore fling themselves over when in normal condition, but no judgment is formed as to the varying height of these middle distances. The low heights they are perhaps able to see distinctly, and therefore to form an elementary judgment.

In such a slight power of judgment we see something upon which the forces of evolution could act, if necessary. But the fact of the matter is that, so far as I am able to understand the Newt's feeling by observing its outward actions, a fall of 180 ctim., even when repeated several times in immediate succession, has no effect upon it, except perhaps a little temporary discomfort.

The hopping Frog has to take "pot luck" as to where it is going to land itself, and there is, of course, no hesitation in that animal in jumping over a precipice, if one got in its way. The Toad, if it is crawling, is always brought to a standstill by the edge of a board. It is curious to observe in this animal, and more especially in the Newt, how frequently it went to the edge of a board without realizing it until the non-contact stimulus of one of its feet attracted its attention, and it immediately looked down.

It has been shown* that land-dwelling Tortoises crawl over 30 ctim. without reluctance. Water Tortoises plunged off without hesitation, but at a height of 90 ctim. hesitated slightly. Amphibious Tortoises hesitated at 30 ctim., and at 90 ctim. showed more hesitation and reluctance.

XI.

The Newt, in both species, has a strong stereoscopic reflex. It is surprising to observe the strength it is able to employ in

* Dr. Yerkes : "Space Perception in Tortoises," 'Journal of Comparative Neurology and Psychology,' vol. xiv. p. 17.

forcing itself under a flat stone. If, in the autumn, a few Newts be left in a large box, which is perfectly empty, they will be found in a very short time together in a large heap, each Newt having come along and thrust itself in under another, until those originally on the bottom of the box become raised to the top of the heap. This observation probably explains the fact that Snakes and Frogs have been found, during hybernation, around each other in a mass.* Whether Newts hybernate sometimes in this way I do not know. The flat nose of the Newt never fails to respond to the stimulus of contact with one surface applied to another so as to leave a suitable crevice.

The tail is used efficaciously as a prehensile organ, but the action of the tail resembles the stereoscopic reflex, as it is an instinctive response to surface contact, for it is seen that, while it apparently with intelligence hooks the tail around an object, it shows in the matter of unhooking a remarkable absence of intelligence. I have seen it struggling to walk forward in vain for minutes at a time, simply because its tail was coiled around an upright post. The fore legs are never used to hold food, and can be only very roughly employed to scrape acid or other stimulus from the head.

Newts, in captivity, soon lose their natural wariness. The commotion at first caused among freshly captured Newts in a tank when someone approaches soon ceases after a short period of captivity.

The Newt's persistency at all times strikes the observer, but the use of such a descriptive term applied to the Newt is very misleading, as it signifies conscious determination to overcome a difficulty which it at least partially understands. The Newt's "persistency" is a recurrence of the already mentioned tendency to repeat an action over and over again. It is an expression of the superiority of its bodily activity over the activity of its cerebral cortex.

In its primary instincts—those of breeding and feeding—the Newt has been shown to display a certain impetuosity which is significant when compared with the usual monotony and sluggishness of the Newt's existence. But this very impetuosity—an

* Dr. Gerald Leighton's 'British Serpents,' p. 60.

advance as it is on the Common Toad and Frog—only serves to show the bluntness of its perceptions.

The mother-liquor, from which all distinctive traits of animal intelligence crystallize out, is a combination of variety of experience and individual mental variation which are largely absent in the Newt. Only a strong effort of the imagination, after a careful, first-hand study of the behaviour of Newts, can conjure up in our minds a comparatively truthful picture of the dreary monotony and automatism of the life of the Newt as a whole. Such a picture, it is needless to point out, is very different from those glowing accounts of the romance of animal life presented to an innocent public in many of our English magazines. There is no harm in these stories if they are honestly given their correct designation—fairy stories. But the pity is that their authors palm them off as Natural History.

RECORDS OF SOME SCANDINAVIAN WOODLICE.

BY RICHARD S. BAGNALL, F.L.S., F.E.S.

IN June, 1909, I had to visit Norway on business, and took the opportunity of extending my journey to Sweden and Denmark. Whilst most of my time was devoted to business matters, I spent several happy hours collecting in the neighbourhood of Bergen, Arendal, and Christiania, in Norway; Gothenburg, Sweden; and Copenhagen, Denmark, taking a Springtail and two or three Thrips new to science. I casually met with a few Woodlice, and as *Trichoniscus roseus*, Koch, and *Armadillidium nasatum*, B.-L., have not before been recorded from Norway or the latter from Denmark, whilst *Haplophthalmus mengii*, Zadd., *Trichoniscus pygmaeus*, G. O. Sars, *T. roseus*, Koch, *Philoscia muscorum*, Scop., and *Porcellio dilatatus*, Brandt,* are apparently new to the Swedish fauna, it is necessary to put the following on record. Had I been aware at the time that the Woodlice of Sweden were not well-known, I should have made a special collection in that group.

Haplophthalmus mengii, Zaddach.—Sweden: One specimen in the public gardens at Gothenburg, June 28th, 1909. An addition to the Swedish fauna.

H. danicus, B.-Lund.—Norway: One specimen in the Tiaenhavn Botanic Gardens, June 25th, 1909.

Trichoniscus pusillus, Brandt.—Norway: Common; Bergen, Stend, Os, Egersund, Fevig, Arendal, Sandviken, and Christiania. Sweden: Gothenburg. Denmark: Near Copenhagen.

T. roseus, Koch. — Norway: In the hothouse behind the Museum, Bergen, with *Armadillidium nasatum* and *Porcellio dilatatus*, June 19th, 1909. Sweden: Gothenburg, June 28th, 1909. Apparently new to both these countries.

* A. M. Norman, Ann. and Mag. Nat. Hist. ser. 7, iii. p. 78, January, 1899. I base my remarks upon a table printed in above paper written more than ten years ago. It is quite possible that the Swedish species have received some attention since then.

T. pygmæus, G. O. Sars.—Sweden: Gothenburg, with *T. roseus*. This minute form is now known from Norway, Great Britain and Ireland, Belgium, and Sweden.

Philoscia muscorum, Scop.—In some places plentiful amongst rank herbage and under stones in moderately dry situations. Norway: By the roadside between Fevig and Arendal, June 23rd, 1909. Sweden: Near Gothenburg. Prof. Sars has never met with this usually common form in Norway, and records but two specimens taken by the late Dr. Jensen; whilst it is apparently not recorded from Sweden. I feel certain that I also saw this species at Egersund, Norway, but there is no note to that effect in my note-book.

Oniscus asellus, Linn., and *Porcellio scaber*, Latr.—Common in all the localities quoted for *Trichoniscus pusillus*.

Porcellio rathkei, Brandt.—Denmark: Two specimens from under the bark of a log in a field at Ordrüge, near Copenhagen, July 1st, 1909.

P. dilatatus, Brandt.—Norway: A few specimens from hothouses at Bergen and at Christiania. Sweden: In the fern-house of the Gardens at Gothenburg, June 28th, 1909. Only three specimens are recorded by Prof. Sars from Norway, whilst it is evidently not known from Sweden.

Metoponorthus pruinus, Brandt.—Sweden: Gothenburg, with *P. dilatatus*.

Armadillidium vulgare, Latr.—Denmark: One specimen from Copenhagen.

A. nasatum, B.-Lund.—Norway: In hothouses at Bergen; a few specimens only. Denmark: Several examples in one of the hothouses of the Botanic Gardens, Copenhagen. *A. nasatum* has recently been recorded in great profusion from hothouses in various parts of the British Isles, whilst I have also recorded it from Belgium in similar situations. These are the first records from Norway and Denmark.

A. pictum, Brandt.—Norway: Several under the bark of an old lime-tree at Bygdo, near Christiania, June 27th, 1909. This species has not yet been recorded from the British Isles, but will almost certainly be found when more attention has been given to the group.

Since Webb and Sillem's 'British Woodlice' was published in 1906 a small band of workers have added considerably to our knowledge of the distribution of known species, and have made several interesting additions to the fauna, including *Trichoniscus pygmæus*, G. O. Sars (England, Scotland, and Ireland); *Armadillidium album*, Dollfus (Devon); *Eluma purpurascens*, Budde-Lund (Ireland); and four hothouse species new to science, namely, *Trichoniscus stebbingi*, Patience (Scotland, England, and Belgium), *T. spinosus*, Patience (Clyde), *T. linearis*, Patience (London), and *Philoscia patiencei*, Bagnall (London and Winton).

NOTES AND QUERIES.

MAMMALIA.

Stoats (?) attacking Lapwings.—At the end of November, 1909, and during the first week in December following, some mysterious animal, supposed to be a Stoat, killed quite a number of Plovers on Mr. Millard's farm at Hethel (which adjoins a farm of mine near Norwich). Mr. Millard picked up four Lapwings and two Golden Plovers, and his ploughmen found thirteen more. All of them are described as having blood on the head, otherwise not a feather was ruffled. The two last ones found, however, had been partially eaten by some creature.—J. H. GURNEY (Keswick Hall, Norwich).

AVES.

Large Clutch of Eggs in Nest of Mistle-Thrush.—Whilst walking near the village of Hucklow, Derbyshire, on May 17th, I found a nest of *Turdus viscivorus* containing six eggs. The nest was unusually large, the eggs were in no way cramped for space, and all were of the same type and well marked. In my eight years' experience of the birds of North Derbyshire I have never known of six eggs in a nest of this species. I have occasionally found five eggs, but the usual number for this bird appears to be four. The nest was situated in the fork of an oak-tree.—J. S. MACDONALD (Bretton Clough, Eyam, near Sheffield).

Strange Nest of Blackbird.—I have read with interest in several numbers of 'The Zoologist' accounts of peculiar nesting-sites of several birds. I had one brought before my notice the other day, which I think is worth recording. It was a Blackbird's nest built in a rhubarb-leaf, and the leaf was standing in its natural position. To keep the nest secure the birds had pierced holes in the leaf, and woven pieces of dry grass round the ribs of it. The nest was very roughly made, there being no lining of fine grass as is usual with the Blackbird, but just a rough lining of mud. It contained three eggs, which were unmistakably those of a Blackbird, and not of a Thrush. It may also be of interest to state that I saw a pair of Hobbies flying quite close to me on May 22nd, and these are the first I have seen in this neighbourhood.—A. W. ECUTT (Commercial Street, Newport, Mon.).

Late Stay of the Fieldfare.—On May 17th I observed a single Fieldfare (*Turdus pilaris*) flying over the Thanet Golf Course. The weather was thick at the time, and the bird had evidently lost its way, for it was calling repeatedly, and making in a southerly direction. This is, I believe, the latest record for Kent.—COLLINGWOOD INGRAM (Westgate-on-Sea).

Observations on the Nesting of Rooks.—In 'The Zoologist' for 1904 (p. 191) I contributed some observations on the efforts of a pair of Rooks (*Corvus frugilegus*) to build a nest some little distance from the main rookery. Several equally unsuccessful attempts have been made in the meantime. This year, however, six pairs succeeded, after a certain amount of hostility from the main body, in completing their nests, and, as I could watch from my windows the old birds sitting on the nests, I have little doubt that the full complement of eggs was laid. For some reason which I am quite unable to explain, not a single young bird has been reared in any of these nests. I began to suspect some little time since that all was not well with the little colony, as one or two of the nests appeared to be deserted, and I examined the ground below to see whether I could find any traces of their having been disturbed, but there appeared to be nothing unusual. Once or twice when the birds were sitting I noticed a number of Rooks perched on the adjoining trees; they did not seem to be over-friendly, but I did not witness any act of aggression. There has been no failure of young birds in the large rookery; in fact, we have shot more than usual. Following the previous destruction of nests whenever an attempt has been made to establish an outlying colony, the facts appear to be very extraordinary.—R. H. RAMSBOTHAM (Elmhurst, Garstang).

Stone Curlew (*Ædicnemus scolopax*) in Bedfordshire.—This bird was observed by a friend and myself at Sandy on May 15th last. It was frequenting an area of market-gardening land between the roads leading to Everton and Pottton, and what was formerly a portion of Sandy Heath. At this date it was more probably a wanderer from some other locality than a belated migrant resting on passage. Years ago the Stone Curlew nested not uncommonly on the Downs on the southern portion of the county, but the last nesting on record was about 1890, when two young that had a quantity of down still adhering to their feathers were shot between Luton and Dunstable. Since then but two other county occurrences can be given of this bird—one in 1894 was killed near Dunstable, and another, which I saw in the taxidermist's hands, had been killed from a ploughed field on

Nov. 3rd, 1904, at Haynes. — J. STEELE ELLIOTT (Dowles Manor, Salop).

Sandwich Terns and White Wagtails in Ireland. — For several years past, while residing at Moy View, Co. Sligo, I regularly kept a record of the dates of the spring arrivals of the Sandwich Terns to Killala Bay, and of the *Motacilla alba* to the island of Bartragh, but having left Moy View and come to reside at Ardnaree, Monkstown, Co. Cork, my friend Captain Kirkwood, of Bartragh House, has kindly undertaken to regularly keep up the future record of dates, and I now give some extracts of his notes for this season. To begin with the Sandwich Terns: they were unusually late; none were observed until April 27th and 28th, although some years ago I observed them in the bay and estuary as early as March 20th. My records from 1851 show that there were twenty-one arrivals in March, *viz.*: 1852, March 23rd; 1854, March 21st; 1856, March 20th; 1877, March 29th; 1880, March 24th; 1881, March 31st; 1882, March 30th; 1885, March 30th; 1886, March 25th; 1887, March 28th; 1889, March 19th; 1890, March 15th; 1891, March 28th; 1892, March 27th; 1893, March 23rd; 1894, March 27th; 1895, March 30th; 1897, March 22nd; 1898, March 31st; 1899, March 26th; 1907, March 24th. It would be interesting to know (now that watchers have been placed at the English breeding haunts) whether the Sandwich Terns arrive at their breeding haunts as early as they do at their Irish haunts, and being such early breeders that I have seen fully-fledged birds with their parents on the estuary as early as June 23rd. The White Wagtails visited Bartragh in unusually large numbers this season, and, owing to the long continuance of north and north-westerly winds, their resumption of their northern flight was delayed until a favourable change of wind to south permitted it. The first arrival of the advance guard was headed by a pair seen on the 5th inst.; afterwards single birds began to drop in, and on the 8th a flock of five birds was seen. Next day several more were observed, and on the 12th a flock of twenty-five birds; some of these left, but on the 14th twenty-two were counted about the marshy pasture (their usual haunt). However, as the wind was changing to the south, by the 19th only a solitary individual remained on the island. During the migratory season, if the winds are blowing mildly from the south and west, very few birds drop down on Bartragh to rest, but the strong north and north-westerly winds always delay their northern flight, and they then make Bartragh the resting-place until the wind favours. — ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Terns feeding upon Sticklebacks.—In some of the dykes in Holland Sticklebacks abound. I repeatedly watched both Black and Common Terns fishing for them and feeding upon them. — R. FORTUNE (5, Grosvenor Terrace, East Parade, Harrogate).

Large Clutches of Eggs.—During a recent nesting excursion to Holland, I saw an Avocet's nest containing five eggs, a Godwit's with six eggs, and a Redshank's with six eggs. The Godwit had four eggs when we first found it, the additional two eggs being in the nest when we visited it three days afterwards. The probabilities are, of course, that two birds laid in the same nest, though this was not very apparent, and there should be no reason for it, for upon the vast area of polders nesting-places are of course abundant. On May 28th, in a nesting-box at Harrogate, I found a Blue Tit sitting upon seventeen eggs. This box is fixed in an oak-tree in the centre of a large wood, and is about twenty-five feet from the ground. We have a few boxes about, and they are all tenanted by Blue and Great Tits. A neighbouring box contained a Great Tit's nest with one egg, and the female dead upon the nest, egg-bound.—R. FORTUNE (5, Grosvenor Terrace, East Parade, Harrogate).

A Note on Bird-Life in the Spessart.—A few notes on the birds observed during a journey on foot through this district, in the company of a German ornithologist, may be of interest. The notes were made between March 24th and 28th, 1910, at which date some migration was apparently in progress. The Spessart, I should state, is a forest district in the north-west corner of Bavaria, about thirty or forty miles from north to south, and rather less from east to west. It is bounded on three sides by the River Main, which makes a deep bend. The forest consists of oaks, beeches, and conifers. The highest points are about two thousand feet high, and are densely wooded. The valley of the river is cultivated for a mile or two on either side of the meadows, which abut on the swift gliding stream. Bird-life was very abundant, though the total number of species was not large. The most interesting and characteristic birds of the forest are probably the Great Black Woodpecker, the Kite, and the Buzzard. But it will be better to go through the list in order. There were a few Mistle-Thrushes in the forest, and song-Thrushes were rather more numerous; the last species, I was told, being only a summer visitor. Black-birds were quite absent from the forest, but I saw a few in the village gardens in the Main Valley. On the evening of March 27th I heard the first Chiffchaff singing feebly at Wertheim, and on the two following days, as we walked down the valley, they were singing in their

hundreds. The weather was warm, and it seemed that migration was proceeding northwards along the river. As might be expected, Tits were most abundant in the woods. We saw vast numbers of *Acredula caudata*, and *Parus major*, *ater*, *palustris*, and *cæruleus*, but no Crested Tits, though they are said to be found. Nuthatches were not uncommon. I saw a few Wrens. Wherever there were streams there were White Wagtails (*Motacilla alba*). These are, of course, summer migrants, but had arrived in thousands, and were all, it seemed, paired. Whether they were still moving northwards I had unfortunately no means of discovering. I saw at some distance one pair of yellowish birds which appeared to be *M. melanope*, but I did not satisfactorily identify them. Greenfinches were tolerably abundant, and we saw a few flocks of Goldfinches. The House-Sparrow was strangely uncommon. We saw very few, and only, occasionally, actually in villages. On the other hand, there were numbers of the more delicately formed and attractive Tree-Sparrows in the old apple-trees by the roadsides. I noted a few Linnets at one spot; also a single female Bullfinch. Yellow Buntings were plentiful everywhere, and in the Main Valley, where there are some small reed-beds, a few pairs of Reed-Buntings were to be seen. Starlings were exceedingly abundant. In the forest there were large numbers of Jays, but Magpies, which are so conspicuous in most parts of North Germany, were absent. On the other hand, in four days I saw more Carrion-Crows than, I think, I had seen in all my previous life. There were thousands of them both in the forest and in the cultivated places. They were all *Corvus corone*, and we saw no Hooded Crows among them. Some were in pairs, but the majority in flocks of two hundred to three hundred. The only birds that were more plentiful than Crows were Chaffinches, of which we saw enormous flocks. Sky-Larks were much less numerous than in the flat plains of North Germany.

Before daylight one morning I recognized the unmistakable song of the Crested Lark, and saw several on the waste land outside the railway station at Hanau. This was the only place where I saw any. The song is sweetly modulated but short and is uttered on the wing, and also, as often as not, when the bird is perched on a roof. Buzzards (*Buteo vulgaris*) seem to be tolerably plentiful in the district. I am told that they are regarded as harmless, and are protected in Germany. We saw several each day and heard their familiar squeals. On the 27th we saw two Kites playing and swooping over the river just outside the small town of Wertheim. Whilst so engaged, one

was attacked and severely buffeted by a Carrion Crow for no apparent reason. It was strange that the huge bird of prey appeared quite incapable of resenting the impertinence of the Crow. On the 28th, about ten miles down the river, we saw three Kites together, and watched them for a long time in the air and perching most conspicuously on bare trees above the road. The Kites were all *Milvus iclinus*. It is possible that they may have been the same as those seen the day before who were migrating by easy stages northwards. These three Kites were in company of four Buzzards, and one had the rare pleasure of seeing these fine Accipitres together on the wing over one's head. The form and flight of the Buzzard and Kite on the wing are strikingly different, though both soar in easy curves with motionless wings. Seen from underneath, the tail of the Buzzard is short, square, and not forked. The wings are obtuse and carried horizontally. The tail of the Kite is long, narrow, and most distinctly forked. The wings are carried at an acuter angle over the back when soaring than those of the Buzzard. The only other bird of prey seen was a single Kestrel. We saw one Heron, and on March 28th a single Stork, apparently just arrived at his old nest and sitting as though feeling the cold. Green Woodpeckers abound, and the bird is an ancient symbol of the Spessart. The Great Black Woodpecker (*Dryocopus martius*) seemed to be fairly plentiful, but very shy. There can be few districts more accessible to the English ornithologist who wishes to study this noble Picarian bird. The flight is characterized by the dipping movement of the other Woodpeckers, and the loud ringing cry has a roll and a deeper note than the familiar "yaffler." I should write it down: "True-true-true," &c. We heard a number, but only succeeded in once getting a view of the bird. In the forest were small numbers of Wood-Pigeons but no large flocks; and I saw a party of half a dozen Stock-Doves drinking in the evening at a brook. An ornithologist who explored the Spessart in May and June when migration was complete and nesting going on would no doubt be well rewarded. The best starting-point is Aschaffenburg on a main line of railway. Excellent maps showing marked footpaths through the forest can be got there.—HAROLD RUSSELL (16, Beaufort Gardens, London).

INSECTA.

Notes on *Culex vexans* (Meigen) and *Osmylus fulvicephalus*.—On March 22nd last I found, in a pool formed by rain-water in a wood, a number of larvæ of a species of gnat. These larvæ in

no way appeared to me to differ from those of *Culex pipiens*, except that they were very large, about 10 mm. long. I took about two dozen or so of these larvæ home, which I confined in a vessel of water. I thought at the time the early date was very much against their being those of *C. pipiens*. All works on entomology I consulted were unanimous in deciding that the breeding of this insect was in early summer. The larvæ I had gradually diminished in numbers, one by one, and disappeared. Query: Were the rest guilty of cannibalism? The remaining larvæ turned into nymphs on May 18th, and the perfect insect appeared on May 20th. This unusually long period from larva to imago struck me as curious, so I sent to Mr. Austen of the British Museum a tube containing larva, nymph, and fly in spirit. He very kindly supplied me with the following information:—"I write to say that the Mosquito larvæ and pupæ are not those of *Culex pipiens*, but belong to the species known as *Culex vexans* (Meigen), about which our knowledge is as yet very scanty. Mr. C. O. Waterhouse found the larvæ of this species in a large pond at Brockenhurst, in the New Forest, at the end of March 22nd, 1905, so that March 22nd would not appear to be an unusually early date for the larvæ; but whether the species passes through the winter in the larval state I am unable to say. Curiously enough, all the perfect insects bred by Mr. Waterhouse are males [mine were also males], and apparently he failed to breed a single female. If you are ever able to obtain females of *C. vexans*, I should be glad of a few specimens for our Collection. They should either be pinned on fine pins, or, if dead, sent dry in a tube containing a few pieces of cigarette or tissue paper in order to prevent the specimens from being injured by shaking about. Your specimens certainly seem to have been an unusually long time in reaching the perfect state; this was perhaps due to the lack of some necessary food material in the water." (My specimens had pond water supplied to them.) It is perhaps worth while to mention that last year I took here numbers of another "New Forest insect," namely, *Osmylus fulvicephalus*, which I sent to Mr. Kirby for the National Collection. Mr. Waterhouse, in acknowledging these specimens, wrote to me that he had only met with it in the New Forest, "but it is not a common one, or at any rate it is very local." In 1908 I saw numbers of these insects at Watersmeet, in North Devon.—GORDON DALGLIESH (The Cottage, Brook, Godalming, Surrey).

NOTICES OF NEW BOOKS.

Concealing-Coloration in the Animal Kingdom, &c. Being a Summary of ABBOTT H. THAYER'S Discoveries. By GERALD H. THAYER. New York: The Macmillan Co.

THE "obliteration" theory of Mr. A. H. Thayer has been enunciated by its author in several scientific papers, and so is known to most students of philosophical zoology; the present beautifully illustrated volume condenses previous advocacy, and gives further evidence for the theory, thus presenting the whole argument in its favour. That concealment by "obliteration" cannot very well be accepted as supporting the usual theory of the purposes of animal disguises is clear from a paragraph in the "Introduction" by Mr. A. H. Thayer himself. He writes:—"This discovery that patterns and utmost contrasts of color (not to speak of *appendages*) on animals make *wholly* for their 'obliteration,' is a fatal blow to the various theories that these patterns exist *mainly* as nuptial dress, warning colors, mimicry devices (*i. e.* mimicry of one species by another), &c., since these are all attempts to explain an entirely false conception that such patterns make their wearer *conspicuous*." Even in birds, "changeable colors of all sorts strongly tend to conceal the birds that wear them, and *iridescence* is extraordinarily potent in this way. Its power is of two kinds, which are, however, practicably inseparable in their working. First, it goes far toward annulling the normal lights and shadows, with their color-effects, of the surface on which it is placed; and, second, its great and vivid versatility of color and shade almost insures the 'matching' of some part of that surface with whatever forms its background."

These two extracts will more or less focus the Thayerian argument, which must almost certainly greatly modify much theory as regards present advanced mimicry and phases in

animal coloration, for which a number of terms have now been invented as though they were theological definitions. The theory of Mr. Thayer describes a universal phenomenon which is more consonant with a progressive evolution than the partial and abrupt disguises predicated in the current teachings of mimicry. All animals in a state of nature seek concealment from their foes, in some form or another all have that protection, and the "obliterative" suggestion thus explains very much. In the evolutionary process all animals must have also slowly acquired a knowledge of the benefits arising from this obliterative protection, so that active concealment by animal volition should be considered as a factor in this phenomenon, a course which will strengthen rather than weaken its comprehension.

In Mr. Thayer's description of the obliterative markings of the Zebra we find no reference to Mr. Francis Galton, who, in the 'Narrative of an Explorer in Tropical South Africa,' published in 1853 (chap. x.), not only discussed the "bright colours of skulking animals," especially that of the Zebra, but may be said to have been the first, in other words, to propound the theory of "obliterative coloration."

The many and beautiful illustrations in this volume supplement and explain the text.

The Vertebrate Fauna of Cheshire and Liverpool Bay. Edited by
T. A. COWARD, F.Z.S. Witherby & Co.

THE two beautiful volumes that comprise this last addition to our knowledge of the local or county zoology of the British Islands are edited and largely written by our old and well-known contributor, Mr. T. A. Coward, who, with another valued contributor, Mr. C. Oldham, are entirely answerable for the first volume relating to the mammals and birds.

Of the mammals, we are told, forty-six species occur or have occurred within recent years in Cheshire and its territorial waters. "Very little documentary evidence exists of the recently extinct mammalian fauna, and owing to the absence from Cheshire of limestone caverns, which have yielded a rich harvest of remains of the Pleistocene Age in the neigh-

bouring counties of York, Derby, Denbigh, and Flint, our knowledge of the more ancient fauna is slight." The marine mammalian fauna is not extensive owing to "the short mileage of the actual Cheshire coast, the shallowness of Liverpool Bay, and the distance of the estuaries from the main route of migratory cetaceans and seals." The Bats are fully treated, and much information derived from actual observation is given; this was to have been expected, for our authors, even in the pages of 'The Zoologist,' have given frequent proof of their local study of these animals. The account of the domesticated herd of polled white Park Cattle kept at Somerford Park, near Congleton, is fully illustrated, and contains many interesting facts and figures.

"There is satisfactory evidence of the occurrence in a wild state of two hundred and thirty-one species of birds in Cheshire during the present and last centuries," and since the publication of the same authors' 'Birds of Cheshire' in 1900 several species have been added to the county list. These comprise the Cirl Bunting, Mealy Redpoll, Woodchat, Shore Lark, Shag, American Blue-winged Teal, Kentish Plover, Schlegel's Petrel, and Baillon's Crake. One hundred and twelve species breed, or bred until recently, within the county boundaries. The Nightingale is included on the grounds of greater probability. At the end of April, 1896, we read that a Nightingale made its appearance in a hanging wood at Oakwood Hall, on the bank of the Mersey, the property then of a late resident, Ephraim Hallam. The presence of the bird or birds attracted "large crowds," and, apprehensive of damage to his property, Ephraim Hallam gave instructions that the Nightingale should be scared away. This was done by the firing of blank cartridges—one beneath the tree in which the bird was singing. "The male was neither seen nor heard again, but it is not certain that the firing was responsible for the silence, as two days later the gardener saw the hen with food in her beak, and it appears probable that the eggs were then hatched."

Vol. ii. opens with an account of "The Dee as a Wildfowl Resort," by Mr. John A. Dockray. It is the same old story of what is called industrial civilization destroying the beauties of nature; adding to the mercantile wealth of a county by the obliteration

of its natural charms. "What must this estuary have been like a hundred years ago? Can we picture it before railways existed on either side, before any serious reclamation had taken place, when there were no puffing, snorting tugs, with their shrill whistles, in the tideway, no clanging steam-hammers or shrieking 'devils' at the unbuilt works, &c.—nothing, in short, to disturb the solitude of those endless miles of flat, flat-marsh, and sand-bank." Perhaps in another two thousand years it may have reverted back to its old condition, and the birds come to their own again. Mr. Dockray's contribution will comfort the soul of the sportsman.

The "Reptiles and Amphibians" are from the pens of Messrs. Coward and Oldham, who have not a wide range in subject. "Although two out of the three British Snakes, the two Lizards, and the Blindworm occur or have occurred within recent years, Cheshire has a remarkably poor reptilian fauna; no single species can be called common."

Mr. James Johnstone has undertaken the enumeration of "The Fishes of Cheshire and Liverpool Bay," and he has done more by giving an introduction to the physical conditions of the Cheshire sea area, and of the systematic position of the species. However, space forbids further extracts from a more than usually important, interesting, and thorough piece of zoological work.

Experiments on the Generation of Insects. By FRANCESCO REDI, of Arezzo. Translated by MAB BIGELOW. Chicago: The Open Court Publishing Co.

THE 'Esperienze Intorno alla Generazione degl' Insetti' is now seldom read, and, like its author, almost forgotten. The book was published in 1668, and reached its fifth edition in 1688, from which this translation has been made. A Latin version appeared at Amsterdam in 1671, while Pouchet (1859) makes mention of a French translation. We must put on the scientific equipment of 1668 to understand what this publication really meant at that time, and what the author dared to say at that epoch, though he fought with the foils of Erasmus and escaped persecution.

Francesco Redi was born in Arezzo, Tuscany, in 1626, sixteen years after the publication of Galileo's 'Sydereus Nuncius,' and six years before his 'Dialogues on the Ptolemaic and Copernican Systems,' at a time "when the twenty-century old authority of Aristotle was still undiminished," while Bruno, Campanella, Varini, and Kepler—all critics of Aristotle—had made straighter the way for Redi.

Redi was mentally brought up under the care of the Jesuit Fathers, his parents were of the provincial nobility, and his father was a well-known physician. Francesco became a power at the Court of Ferdinand II., and of his son and successor, the bigoted Cosimo III. Although Redi never lost the friendship of the Jesuit Fathers, he effectually disposed of another Aristotelian theory or acceptance—that of spontaneous generation in animal life. This is his fame and the reputation of his work. He commenced by simple experimental methods, first, with three dead Snakes, which were placed in an open box to decay; and we need not recapitulate the discovery of "worms," their subsequent pupal condition, and the ultimate emergence of flies. Even then he began to believe that the worms were derived directly from the droppings of flies, and was still more confirmed in this belief by having observed that before the meat grew wormy flies had hovered over it, of the same kind as those that later bred in it; whilst he further stated: "Nor am I in the least degree convinced by the authoritative statement of Father Honoré Fabri, of the venerable Company of Jesus, who asserts, in his book on the 'Generation of Animals,' that flies always drop eggs and never worms." It is clear that at this time Redi was behind the outlook of Fabri, and had yet much to learn.

The argument used by Redi against the spontaneous generation of bees is, of course, more or less vitiated by his confusion of the drone-fly (*Eristalis*) with the bee (*Apis*), and he affirmed against the opinion that bees originated in the flesh of bulls, even though "the learned Father Honoré Fabri, whose famous works will never be buried in the gloom of oblivion," reiterates this belief. But here our experimental observer was "sharply reminded" of the fourteenth chapter of the Book of Judges, containing the observations of Samson on this matter. Of the

opinions of other contemporary philosophers which must have vexed the spirit of Redi, we read of Servius, the Grammarian, who "turned everything topsy-turvy by asserting that drones come from horses, hornets from mules, and wasps from asses." We have also a delightful account of one experiment made by our reformer. "Having had frequent proof that animals killed by a snake's bite, or by tobacco, which is a terrible poison, can be eaten with impunity," he gave some Pigeons killed by "the sting of the angry Scorpion" to a poor man, "who was overjoyed, and ate them with great gusto, and they agreed with him very well."

Here we must leave Francesco Redi, and with no better remembrance than his modest termination to his book, which was addressed to Carlo Dati:—"In the meanwhile, be assured that this letter or book, as you please to call it, has come to you not for praise but for correction, which I heartily beg you to give; being well aware that—

'My name unto the world is little known.'

The translation appears to be well done and expressed in simple language, while the book may well be read as a description of the biological outlook of two hundred and fifty years ago. Let us also modestly consider what may be the biological verdict of our present-day conceptions two hundred and fifty years hence.

The British Freshwater Rhizopoda and Heliozoa. By JAMES CASH. Assisted by JOHN HOPKINSON, F.L.S., &c. Ray Society.

IN our volume for 1906 we drew the reader's attention to the first volume of this monograph; the second is now published, and contains the second part of the Rhizopoda.

It is one of the merits of most monographs that they soon become behind the time; they focus the knowledge to date, arouse enthusiasm in new workers, and thus cause the publication of other work which should represent new material and method, but which would never have appeared but for the earlier volume. The very first paragraph in the present volume is

illustrative: "Owing to the discovery in Britain, since the first volume of this monograph was published, of Arcellida belonging to genera not then known to be represented in this country, the list of British genera of the Arcellida on page 37 of vol. i. requires revision."

James Cash, the author of these volumes, appears to have been one of those naturalists whose work is of the patient character, and whose personality is unobtrusive. Mr. Hopkinson, in his history of the work, writes:—"In November, 1902, amongst the letters written to our late Secretary, the Rev. Dr. Wiltshire, I found one dated 8th July, 1902, commencing thus: 'A life-long friend, Mr. James Cash of Manchester, has devoted thirty years' time, special knowledge, and enthusiasm to the writing of a monograph on the Rhizopoda. He has also done with his own hands an excellent and adequate equipment of plates to illustrate the text, and, I speak as an old Quekett man, these drawings are distinguished by an ideal measure of faithfulness to nature, loving care, and artistic beauty.'" The work had been offered to two of our chief publishers of natural history books, who, while expressing approval, would not undertake the publication without the author would bear the whole financial risk. Here, again, the Ray Society, by its publication of Mr. Cash's monograph, has proved itself a real patron in natural history. The author, however, died somewhat suddenly in 1909, and to Mr. Hopkinson belongs the credit of not only editing this work, but also compiling its extensive synonymy.

This second volume contains plates xvii. to xxxii., many of which are coloured, besides numerous figures in the text.

Bulletin of Entomological Research. Issued by the Entomological Research Committee (Tropical Africa), appointed by the Colonial Office. Vol. i. part 1. Longmans, Green & Co.

THERE can be no doubt that this newly appointed Research Committee should effect quite a revolution in our knowledge of the economic entomology of Tropical Africa. Under the presidency of the Earl of Cromer an influential Committee has been formed, some members of which are well-known economic

entomologists. The Scientific Secretary is Mr. Guy Marshall, from whose knowledge and energy much may be expected, and he has edited the first number of the 'Bulletin,' which contains several papers of no inconsiderable importance.

When we consider the large amount of work that has been done in this field by many workers at their own loss in time and money, it is indeed cheering to find our Government at last taking the matter in hand, and by State aid giving an impetus to a study that is important to every civilized community, and which has been raised to the highest consideration in the United States of North America. In South Africa there are already several State entomologists, distributed in the Cape Colony and in the Transvaal, and the outlook is very different to what it was in quite recent times, when President Kruger refused to aid in the destruction of predatory locusts on the ground that those insects had been sent by the Deity as a punishment for the sins of the land.

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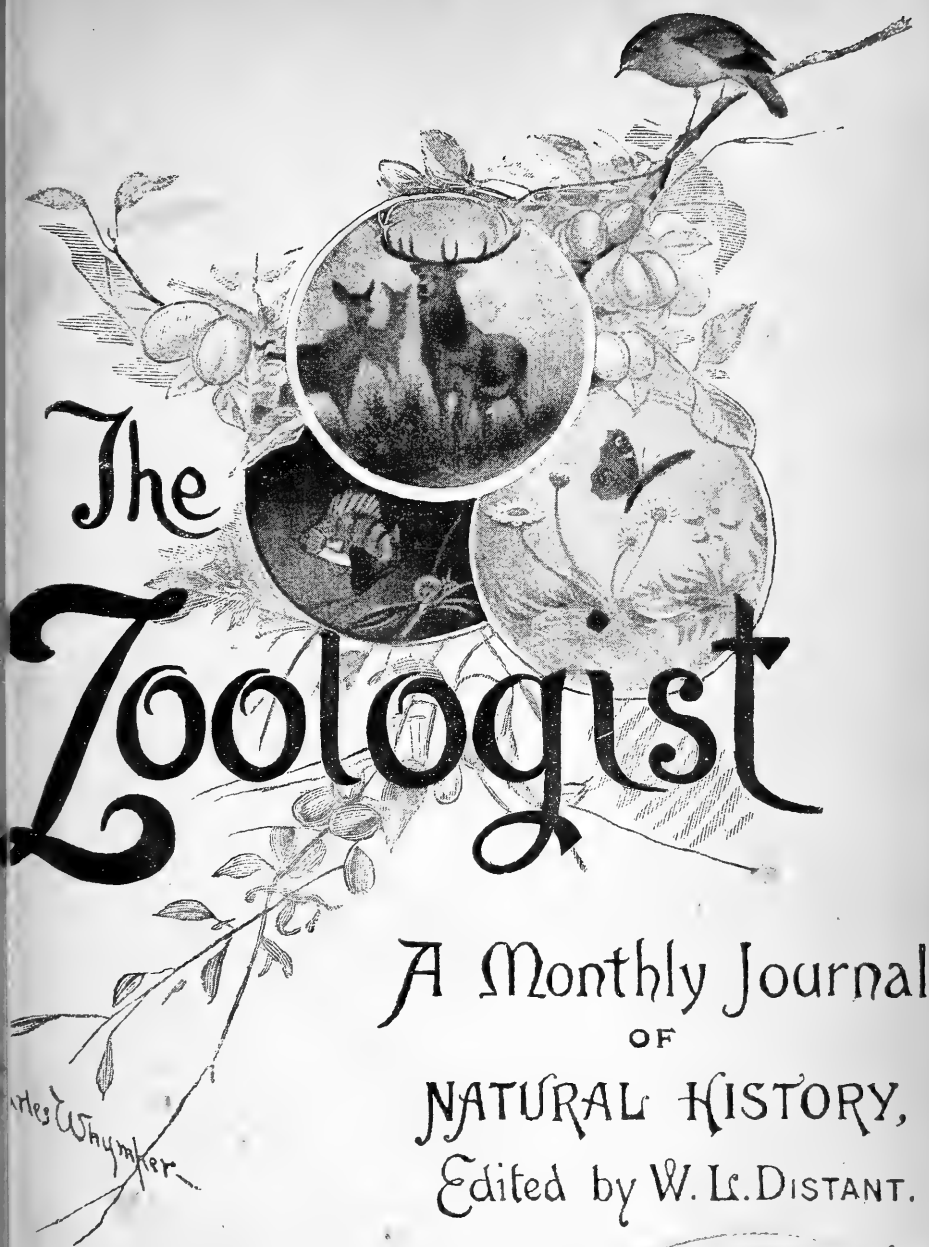
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THE ZOOLOGIST

No. 829.—July, 1910.

ON THE VALIDITY OF THE YELLOW-NECKED MOUSE
(*MUS FLAVICOLLIS*, MELCH.) TO RANK AS A
SPECIES, AND NOTES ON *MUS SYLVATICUS*.

BY GORDON DALGLIESH.

(With Comments by J. G. MILLAIS, F.Z.S.)

IN a previous paper of mine ('Zoologist,' 1907, p. 300) I pointed out my reasons for claiming *Mus flavicollis* as a valid species. Since this was written, other important facts have come to light which tend more than ever to strengthen this supposition. The discussions and arguments that have been propounded as to the qualifications necessary to determine "What is a species?" are manifold, and the more one dips into this intricate matter the more one seems to get hopelessly bewildered. As far as can at present be seen, we always appear to end at the point from which we first started. A case in point might be cited with regard to the different races, species, or subspecies of Colchican Pheasants. Some naturalists will regard these all as separate species; others as merely local races or subspecies. The former argue that the variations are constant in each individual, so, on this account, they must stand as good species. The latter, regarding them merely as subspecies, do so because they observe all breed *inter se* with each other, and the offspring of these are fertile. This in itself would be con-

clusive proof that there was only one Colchican Pheasant, and the numerous phases of plumage were variations. Unfortunately, this theory is completely upset by the fact that *true* mules or hybrids, the offspring of undoubted separate species, are often fertile. Thus, take two such totally distinct species of Ducks, the Pintail (*Dafila acuta*) and the Mallard (*Anas boscos*). If these be crossed, the result of such a union is fertile. These hybrids in their turn then cross with either species, producing offspring. Yet no one could possibly claim the Mallard and Pintail as one species! This digression is necessary to explain how hopelessly bewildering is the making of a species. It has often surprised me when dealing with zoological problems to find how little climate is taken into account in the attempt to explain variations in different forms. But, again, climate usually tends not one whit to alter a species found in totally different quarters of the globe. One might go on *ad infinitum* dividing and subdividing the different races of *Salmonidæ*, when the results would be far from satisfactory. For my own part, I see nothing very remarkable in *Mus sylvaticus* and *Mus flavicollis* inhabiting the same area, though at this some people have expressed surprise. What I maintain is: that *Mus flavicollis* is gradually but surely in many places ousting *Mus sylvaticus*, and establishing itself as a species. On the other hand, it is, in some districts, either dying out or migrating to fresh quarters. I am inclined to take the former view, for this reason. I have picked up several dead and dying specimens of *Mus flavicollis* (some of the latter were already "fly-blown"), but have very rarely seen a dead—natural death being the cause—*Mus sylvaticus*. In the year 1907 I never failed night after night to trap half a dozen or more Yellow-necked Mice in my garden. During 1908 I never caught a single example, and this year—1910—Yellow-necks are at a premium, for, up to the present date, May 19th, I have only taken one. Barrett-Hamilton* has given us an excellent monograph of *Mus sylvaticus* and its subspecies, and, whether we all agree or not with his classification, this must, for the present, remain our standard work on these Mice. All who are interested in small mammalia would do well to read the conclusions of this painstaking naturalist. My claims for

* Proc. Zool. Soc. Lond. 1900.

regarding *flavicollis* as a valid species were, as previously stated, given in the paper referred to above. As to the further facts which I regard as making the validity of *Mus flavicollis* as a species more binding, I have received a communication from a well-known naturalist, whose opinion should certainly carry weight. He wrote to me as follows:—

“I am glad to find someone who has come to the same opinion as myself as to De Winton’s Mouse (i. e. *flavicollis*) being a species and not a variety of *Mus sylvaticus*. One of the strongest facts is their difference in disposition and habits, and in these characteristics they are as different as possible.

“Many consider, as I said before, that the Yellow-necked and the Wood Mouse are only varieties of the same species. I do not, for the following reasons:—

“(1.) *Mus sylvaticus* is a gentle animal, easily tamed, good-natured, so that many can be kept in a cage together and no fighting takes place. Gentleness and kindness are their characteristics.

“(2.) De Winton’s (i. e. *flavicollis*) is as savage as a Norway Rat, rushing at the finger and biting in a moment. You cannot keep two males together. They fight most savagely at once, even when the season of rut is passed. They fight to the death.

“(3.) You never see a Mouse with the long tail without it being accompanied by the Yellow-neck” (here this gentleman’s and my experience coincide) “big ear and foot, and on no occasion do you ever find a mixture of the characteristics of the two species.*

“(4.) If you put a female Wood Mouse with a buck Yellow-neck he instantly attacks her, and will kill her if she is not removed from the cage.

“(5.) If you are in a district where both occur, and you find that Field Mice are invading your house and store-room, you will trap five Yellow-necks to one *sylvaticus*, and the latter are twenty times more numerous.

“(6.) In the autumn you may turn out fifteen or more *sylvaticus* from one burrow, but who ever saw more than a male and female and young come from a Yellow-neck’s burrow? I

* *Vide* Mr. Millais’s remarks below.

feel quite sure, judging by habit and disposition, that these two Mice are of separate species. Also by the fact that you never see a specimen where there is a mixture of the two characteristics. I think I may speak with some authority on this subject, as I always keep, and have done so all my life, a number of the small mammals native of Britain."

Here these interesting notes end, and, I thought, were fairly conclusive until I had a letter from Mr. J. G. Millais. This gentleman, at my request, very kindly read through this paper, and wrote to me as follows:—

"I agree with you in that *flavicollis* is a good species. *Mus flavicollis wintoni* is a subspecies. A slightly different island form of the Continental one, and is, I think, *our* form of *Mus flavicollis*. It is distinctly smaller and less richly coloured* than those of Hungary, Bohemia, &c.

"The large form of *Mus sylvaticus* from Shetland is just as large as any *wintoni*.

"I am convinced *M. wintoni* and *sylvaticus* do not always fight" (here Mr. Millais's experience and my above correspondent's differ) "and kill each other, but frequently breed together.† I have plenty of *Mus wintoni* (i. e. *flavicollis*) and *sylvaticus* and the hybrid here in my garden. I agree with you that what you call *flavicollis*, i. e. *wintoni*, is on the increase, certainly in the southern counties."

I consider myself most fortunate in having the opinion of so great an authority as Mr. Millais, whose splendid volumes on British mammals must, at any rate for years to come, stand unrivalled. As a help to those who I earnestly wish would try and work out the range of *Mus flavicollis* in Britain, I give below a minute and detailed description of an adult and typical *flavicollis*, together with its synonymy and average measurements.

THE YELLOW-NECKED MOUSE.

Mus flavicollis, Melchior, 'Den danske Stats og Norges Pattedyr,' p. 99 (1834); De Winton, 'Zoologist,' 1894, p. 441.

* I have an example from Gloucestershire which is one of the brightest coloured *flavicollis* I have ever seen.

† Personally I have long suspected this too.

Mus sylvaticus typicus et Mus sylvaticus wintoni et Mus sylvaticus princeps,* Barrett-Hamilton, 'Proc. Zool. Soc. Lond., 1900, pp. 404-6-8 (plate xxv. fig. 1). *Mus flavicollis wintoni*, Millais, *in lit.* (*vide* remarks above).

Description.—A fine and remarkably handsome Mouse, whose general form does not differ from *Mus sylvaticus*, but easily distinguished from it by the following important characters:—Tail,† as a rule, exceeds, rarely equalling, head and body. Size much larger than *Mus sylvaticus*. Upper parts a rich yellow-brown, darkening towards the back into a well-marked deep brown inclining to blackish, dorsal streak. Cheeks and sides of body yellowish brown mixed with black, brown, and golden hairs. A well-defined collar (or breast mark) and pendant present, of a light yellow, varying considerably in size (usually about 8 mm. broad), in some specimens extending below the front legs. In others, again, the breast band may take the form of an irregular blotch completely covering the breast and even extending to the belly. Throat, below the cheeks, and belly *pure white*, showing no dark hairs whatever. This is separated from the above parts by a well-marked line of demarcation. Under side of tail covered with white hairs. Measurements (approximate):—*Head and body*, 99 mm. *Tail*, 100 to 104 mm. *Hind foot*, 22 mm. *Ear*, 14 to 18 mm. *Skull* considerably larger than that of *sylvaticus*.

Regarding our present knowledge of the range of *Mus flavicollis* as far as Britain is concerned, it seems local in its distribution, but occurs commonly where it is found. Even in a district where it is common it is restricted, I have found, to certain areas. I have known one spot, about an acre in extent, where I was pretty certain of finding these Mice.

Flavicollis, up to the present, is recorded from Hereford, Northampton (De Winton), Suffolk (Tuck), Essex (Laver), Gloucestershire (Jeffreys), Sussex (Millais), and Surrey (*ipse et* Messrs. Mouritz and Dent). It doubtless occurs in many other

* *Mus s. princeps* I cannot regard otherwise than a fine and typical *Mus flavicollis*.

† For a full description see De Winton's paper, 'Zoologist,' 1894. This volume may not be available to all naturalists, and for the convenience of these I again describe it.

counties only awaiting discovery there. I am not aware of any records from Scotland, Ireland, or the isles lying off Britain. A specimen is said to have been taken in Jersey, but this was not authenticated. Specimens of the Long-tailed Field Mouse type from that island which I have seen were all *sylvaticus*, though certainly of a richer colour than those of the mainland. I have a flat skin of a *sylvaticus* Mouse from Jersey, which, in the brightness of its pelage, very nearly rivals *flavicollis*. As I write this, word has been brought to me that a number of *flavicollis* were trapped in the cellar of a house in this neighbourhood (Godalming), where they had attacked a store of potatoes. Intelligent country people here easily discriminate between *Mus flavicollis* and *sylvaticus*, one man having informed me that the former were "as large as young Rats." *Mus sylvaticus* enjoys a large share of popularity in the current zoological literature. It has been studied perhaps more, or quite as much, as any other British mammal. Its range includes nearly the whole of the palæarctic* area, reaching the confines of the Oriental region in Gilgit; that is to say, if the *Mus arianus* of Blanford is identical with the present species. This Mouse, which is termed the Persian Long-tailed Field Mouse in the 'Fauna of British India,' is thought by later authorities to be merely a variety of *Mus sylvaticus* of Europe, perhaps hardly entitled to subspecific rank. In many places throughout the vast palæarctic area, *Mus sylvaticus* has, under varied climatic influences, formed many species, races, or variations, whatever its numerous bibliographers choose to term them. Being hardy and exceedingly prolific, it is not hard to understand how this Mouse has won its way through the enormous area it inhabits in the struggle for existence. Even on bleak, wave-surrounded St. Kilda it is found, having here adopted a further variation from the type, and is thought by some to be, if not specifically distinct, entitled to at least rank as a subspecies, and has been named *Mus hirtensis*. Judging from the plate of this Mouse (Proc. Zool. Soc. Lond. 1899, pl. ix.), the specimen figured appears to be a variety of *flavicollis* rather than *sylvaticus*. One of the most interesting problems in zoology is how an island so remote from the mainland gets colonised by mammals.

* It is said that the only mammal indigenous to Iceland is *Mus sylvaticus*.

In many ways this can be accounted for geologically. Another interesting fact is that these island races in the case of Mice and Voles are often of a larger size than those of the mainland. Within quite recent years we find a Vole on the Orkneys related more or less to the Common Field Vole, a Vole on Guernsey also of this type, two Bank Voles, one from Skomer Island and the other on Jersey. All these exceed the mainland forms in size. As mentioned above, Mice of the *sylvaticus* type are frequently found in houses, and are also often found in granaries. It is therefore not difficult to see how easily they could be imported in sacks of corn or bales of hay to islands, where, in the course of time, they would soon found colonies, and possibly under different climatic influences the descendants diverge from the type, forming at first a variety and then a species.

AN OBSERVATIONAL DIARY ON THE NUPTIAL HABITS
OF THE BLACKCOCK (*TETRAO TETRIX*) IN
SCANDINAVIA AND ENGLAND.

BY EDMUND SELOUS.

(Part II. ENGLAND.)

(Concluded from p. 182.)

May 9th.—Having some seven rough miles to go, with, but seldom on my cycle, almost all up hill and with two very long and steep ascents, I started before 1 o'clock from the sofa in my sitting-room instead of going to bed. It rained and blew a good deal as I crested the moor, but at last, after a hard toil through the dusk, I got to the place, and some time after 3 got seated in a deer-gap amidst a long hedge of beeches, surmounting a turf wall, immediately facing the damp grassy space, dotted with tussocks of long, coarse grass, and surrounded by the same, which is, here, the birds' meeting-place. I had not sat there many minutes, and there was, as yet, no sign of its lightening, when some half-dozen shadowy yet solid-looking forms, a little blacker than the night, came whirling high over the hedge, and sank down a little beyond it. As they did so, at once on all sides, the shadows of the earth became musical with the various notes of the birds, and long before I could see them with the naked eye, I could, with the glasses, make out, in a dim black world, the still blacker forms of the cocks. From their activity there could be no doubt that some hens were there too, and, as it lightened slowly, it became apparent that courtship was proceeding. This presented no very new point, but gradually it impresses itself that the hens come to these places, where the cocks assemble to wait for them, in order to be courted by the latter, and to mate with this bird or that. This last—that is to say, the actual coition—is attended with more difficulties than is the case with the Ruffs, the tendency amongst which birds of

other and rival males to stand quietly by, whilst the object of the one is effected, I have drawn attention to in a former paper. Here, however, it is otherwise. The surrender of the female has a violent effect upon non-favoured males, who run to interfere, so that, were the meeting-ground no larger, in proportion to the size of the birds, than is that of the Ruffs, it would be difficult for matters ever to be carried to a conclusion. But this is not the case. It greatly exceeds it in dimensions, and the males, except when fighting, or (what is more frequent) offering to fight one another, stand at a corresponding distance apart, so that as the rite is, for the most part, quickly performed, it is not often put a stop to by scandalized fellow-pretendants. Sometimes, however, it is. For instance, in one case, this morning, two cocks came rushing up, and, in a moment, all four birds were entangled, as it were, in a heap. Yet even here, when the first scrimmage was over, there was no good honest fighting, but only rushings about.

This was the only actual mating that I saw, or, at least, can remember, during the first and most active state of things, from the first commencement, at or before dawn, to the time when the hens, who were never many, had flown away, leaving some twenty cocks on the ground. It was not till after 5 that a single hen again flew down upon it, her appearance producing a curious scene of excitement. Everywhere cock birds leaped into the air with excited "kee-kees," generally supplementing the leap with a short flight of a yard or so, before again coming down. In fact, the arrival of this one hen, upon an outside part of the widely extended arena, produced a general commotion, all over it, which began whilst she was still in the air. She now advanced slowly into the arena, courted, as she went, by first one and then another male, often by two or three together, seeming struck, all the while, making those constant little, odd, jerky pauses to which I have before alluded, but still going on, and thus, in spite of some following her, passing gradually from one male to another—for each has his own more especial domain like the Ruffs. At length, however, one bird seemed more to her liking, she paused more frequently, at length stood still, then crouched, and coition was effected. Here, then, is choice and selection on the part of the female bird. She came evidently for a certain

purpose, having attained which she left; but had it been indifferent to her which male bird she received, she need not have gone further than the first. The fact that she did shows that the act which she sought was recommended to her, in varying degrees, through the varying personal cynation of different males, and as each one elaborately displayed the same points in his plumage, before her, we must assume these—that is to say, the sum total of each bird's appearance—to have been the determinants of her choice. It is strange, I think, that this should ever have been thought strange.

Very few hens, as far as I could see, came to this assembly-ground, though so numerously attended by the males. I do not, in fact, remember seeing more than two together, and these once fought, though in a minor degree. The meetings would appear to be of the males, the hens attending them, merely from time to time, which is what the Reeves do also, so that, in either case, the supposed indifferent hen comes for a certain definite purpose, thus taking the initiative quite as much as the male.* Possibly the hens attend various meetings, but of the male birds doing this, in order to fight at each (as has been stated), I have seen no evidence, either here or in Sweden, for the number is early made up, and then remains the same, or nearly so, till the assembly disperses. Fighting, moreover, to go by what I have as yet seen, is a very secondary matter. The males do not come to fight, but to court the females, on whose attendance they wait. Fighting is merely incidental, and there would seem to be far less of it than is generally supposed.

I have remarked on the excited leaps into the air, from time to time, of the males, with short flights from one part of the ground to another. It is difficult to look upon these as in the nature of a challenge to rival males, or as proceeding from martial ardour. They were excited, in a special degree, by the later arrival of a single hen, and would seem to spring primarily from ordinary sexual emotion, though this is, no doubt, associated with those of jealousy and rivalry. They are generalized rather than specialized actions, and neither they, nor the far

* A Blackcock meeting-place is, in fact, a sort of Yashawari, where the males stand, each in his place, and to which the hens come to walk about and choose from amongst them.

more wonderful *pas seul*, into which they would seem to have passed, have anything to do with the direct courting of the female, so that any argument in disfavour of sexual selection which has been based on this assumption is without any force or relevancy. The "dance" or frenzy, in all its stages, would seem to be merely an outlet for violent sexual excitation (provisionally, at any rate I regard it as such), and has nothing to do with the actual courtship, this being a serious, methodical and business-like matter, having for its object the exhibition by the male bird of his plumous and other adornments to the best advantage before the female (which mere "dancing" or leaping does not effect), and is performed in the same general way as by the common, and other, species of pheasantry.

Not one, however, out of the twenty odd birds on this large ground, nor out of the half-dozen or so at the smaller one, has done anything approaching to the mad dance, or rather whirlwind, which I saw once enacted in Norway, whilst the Swedish performances of this nature were not at all superior to these English ones. As, this, therefore, is only one out of more than thirty male Blackcocks, it would certainly seem as though the more finished performances of this kind—the "war-dance" or "dance" *par excellence*—were only exceptional. Why this should be so, or why this exceptional development should ever have come about, I do not know. One could understand birds, in the prime of bodily vigour, being the best performers in this kind, but many such should be included in the numbers which I have now watched, and, moreover, the difference between the mean and the zenith seems, here, unaccountably great.

May 10th, 11th, or 12th.—Was on spot at 2, the moon being a little more than half. First voice of the night, or early dawn, about 2.30—the Curlew's quavering, melancholy cry. At 3.15, in the earliest morning mist, and light, the first birds fly over the hedge on to the assembly-ground, but for some minutes they are silent. Then a Lark sings, and, a moment afterwards, the concert opens—the angry "chu-way" notes preceding the whirl as usual—and more birds now dash down. It is, indeed, a wonderful volume of sound, and such as one can hardly believe to be issuing from the throats, as I suppose, of at most some twenty to two dozen birds. The curious harsh,

strained "chu-whay-ays" rise strangely from a full chorus of whirbling (a sound somewhat resembling the quick earnest cooing of Dove-cot Pigeons, but louder, and with very much more poetry in it), to both of which, and that other plaintive note of full hostility, is added the whirr of wings, as one or other of the excited birds, and often several together, leap into the air, as also—but this is very occasional, and never lasts more than a few seconds—the sounds of violent blows of wing on wing, denoting an actual encounter.

On account of the mistiness of the morning—wondrous effects on the near and distant hills as it lightened—it was much longer before I could see even the cock birds, either with or without the glasses, and longer still before the form of a hen, here and there, was discernible. These, as before, seemed very few in number; I, in fact, do not clearly remember to have seen more than two, on the ground, at once, nor did more than a single one fly in, at a time, and this only twice or thrice—since it lightened, of course, that is to say; how many may have done so, and gone off, again, invisibly, I cannot say. I was witness, this morning, of two coitions, though, of course on such a large space, with so much of tufted grass upon its outer margin, in which several of the birds were, and especially whilst it was still too dark for me to see, there may have been more. In the first case, a hen walked right down over the ground, almost from end to end, till she came to a certain bird, whom she, as it were, by this, invited to court her. He did so, of course, on which his nearest male neighbour came up and interfered. There was a scuffle, of very short duration, between them, but for the most part they merely got in each other's way, so to speak, strutting past and following one another. Then they fell away, a little, each walking about importantly, eyeing the other, and were thus occupied, and still at pretty close quarters, when the hen, going quickly up to the one she had at first come to, crouched, and coition was effected. The rival, however, at once interfered—perhaps successfully—and the hen, running out from the struggling birds, shortly flew away. In this case, therefore, the hen seems certainly to have chosen a male, nor was she diverted from this predilection, but asserted it a second time, acting with decision and address. In the other instance I

have alluded to, the hen also went either up to, or within the radius of, a certain male, the result being exactly similar, except that, as the formal courtship was here less lengthy, there was no occasion for a second manifestation of preference. Two hens, therefore, have each had a will of their own, and fighting has had nothing to do with either of the two cocks being the favoured one.

Another hen was courted for a long time, and very assiduously, by a cock, who certainly succeeded in driving several other ones away, rushing out at them from the area in which he revolved about the object of his desires, putting them to flight or preventing their coming nearer, and then returning to continue the courtship. But in spite of this, and the impressive pains he took, though she often seemed to hesitate, yet this hen never yielded during the considerable time that I watched the drama, though she possibly may have done whilst I was watching some other one. There was nothing, however, to suggest this, and when she finally walked off the ground, she was followed and courted, for some distance, by another bird before flying away, from which I feel sure that she retired unconquered. This pair of birds were on the part of the ground nearest to me, and I had a fine view of the courtship. The cock went either on one side of the hen, passing ahead as she walked, or else paraded half-round and in front of her, and, either way, the white feathers of his tail must have been very conspicuous—presented to her, as it were, in a back view. Now, as I have seen the Pheasant court, he makes no such wide circlings as this, and, as he presents no particular view from behind, this is significant and interesting. The particular courting actions were as I have before described—slow, pompous, methodical—no leaps or springs of any kind. Yet of these, though they never approached to that peculiar state of frenzy which I have only once, myself, seen, there was no lack amongst the cocks, at times, when they were *not* courting the hens. Observation shows, therefore, that the latter are won, not by this, but by a quite different form of display, specially adapted to set off the beauty of the male's plumage, point by point, or rather all points together—scientifically, in short. For this alone, as a spectacle, the female bird has eyes; mere uncouth violence,

though effective enough for us, she does not appreciate. It exhibits something, indeed, but that something has not grown up along the lines of her feminine admiration, and if she concerns herself with it at all, it is only, as I conjecture, with some ulterior motive. Thus, this morning, whilst two cocks were at blows, a hen, in all probability the subject of their rivalry, ran in between them (as I have seen the female Redshanks or Kentish Plover do), and appeared to offer one her assistance. But if so—and the motive is otherwise obscure—this was probably only because she was partial to the bird she endeavoured to help. Indeed, had the fighting in itself interested her, she would not have endeavoured to put a stop to it, any more than to the legitimate nuptial display, which I have not yet seen any hen do.

Though, as I have said, the actual fighting of these Blackcocks does not amount to much, and in point of duration is nothing to that of a pair of male Coots or Redshanks, yet it cannot be denied that the birds' thoughts seem full of it—that their spirit, at any rate, is martial in a high degree. Whilst waiting for the hens, one or other of them will constantly run over—often quite a long distance—to where another is standing, which other will then advance to meet him, and the two will stand threateningly, front to front, or walk pompously, side by side, at a wary distance, and then come springs into the air, with the angry challenging note that accompanies each—in fact, there is a constant high militant bearing, a parade, as it were, of readiness, an eager offence-seeking spirit, that seems to say, “I am for you, sir,” or “I *do* bite my thumb at you, sir.” But what I say is that, whilst all this is going on, a pair of humble Tits would be fiercely fighting, perhaps even to the death. Some part of the spirit of display, merely, seems to have passed from its proper sphere of courtship, and to clog what should here be deeds. True it is that the springs are sometimes accompanied (though not as yet very frequently) with sparring, pecking, and buffeting with the wings. Nothing could be more vigorous than all this, whilst it lasts, but it lasts, as a rule, for such a very short period of time, whilst for once that even this comes of it, a dozen times, perhaps, or more, nothing does—it begins and ends in inflation, as though that dear bladder were too precious

to be burst in a fight. What one so seldom sees, yet what, with all this, one has some right to expect, is a good set-to battle, both whole-hearted and prolonged. The number of times that these so martial-looking birds stand bill to bill, with every appearance of being about to devour one another, yet do *not* devour one another, or even fall-to, is remarkable, and as depressing for the onlooker.

May 13th.—Was ensconced by a little after 2. The Curlews, as usual, first greeted the dawning, and were followed some time afterwards—3.12 by my watch—by the “chur-whais” and more plaintive angry notes of the Blackcocks, after several had dashed down, over the hedge, in the darkness. It is not till a perceptible time after this that the more musical whirbling, or rukling, begins. My observations of this morning were not quite the same as those made hitherto. Arrivals of hen birds began as usual—so far, that is to say, as it was possible for me to see them—with the first light, and seemed quite over, long before 5. As usual, also, they were few, nor was I aware of more than two on the ground at the same time—I should doubt if half a dozen in all came down. This time, however, the hens were more than usually “coy, difficult and hard to please.” One that I watched for quite a long time was most assiduously courted by one male, in particular, who certainly was fairly successful in keeping the ground to himself. But although the hen was plainly affected by his advances, kept pausing—in fact, advanced only in a series of little pauses, represented by sudden and, as it were, compelled stops—and although, moreover, she several times, half or more than half, crouched, yet, as he came up, she would always make a little dash away, on which the whole tedious ceremony of courtship on the one side, and nervous irresolution on the other, would begin afresh. In short, the patient, long-enduring assiduities of the beau, continued as they were with an ever-increasing impressiveness and sense of the gravity of the position, without any perception of its ludicrousness, made quite a remarkable spectacle, and though the coy, or nervous, little lady was never quite won by them, yet their effect upon her was more interestingly significant than if she quickly had been, she seeming, indeed, to be, all the while, under a spell, from which she could never quite break away. Then gradually she received

more variety of attention, owing, partly, to the way in which her more special admirer would leave her, to run fiercely out at rival, though often quiescent, and almost indifferent, males, a good way off, when, as she walked on, always in the same nervous, hesitating way, she came within the sphere of other more active suitors. One of these wooed her in a very much swifter, brisker, more hurrying way, not nearly so measured or pompous—but this seemed to take far less hold of her fancy, and, in a word, after acting more or less in this way for a long time, and disappointing, and well-nigh exhausting, the patience of several males—but none more so, had he not been inexhaustible, than the one I have specially mentioned—she at last flew away without having been prevailed upon—for this was far more the impression made upon me by her conduct than that of coquetry. It was as though, amongst a number of magnets, the drawing power of which was plainly, though variously, apparent, not one was sufficiently powerful to draw quite effectively—and this was my own reading of the drama.

Another courtship was interesting as giving rise to an unmistakable exhibition of preference on the part of the hen bird concerned. The latter had been courted by a certain male, but another male had interfered with this, and was now courting her himself, when, making a distinct double-back (by distinct I mean that it was obviously intended) to her old wooer, by which she as patently avoided his substitute, she immediately crouched to him, a stratagem which, however, was only partly effective, owing to the prompt interference of the jealous rival. Here, then, was an evident instance of choice on the part of the female.

Another hen was courted by several males, who, as is much more the case with these birds than with Ruffs, mutually wrecked each other's chances of success. The most marked feature here was the conduct of one particular cock, who, instead of courting in the orthodox manner, resorted entirely to force. There were some four or five attempts of this nature, from the last of which the hen seemed only just able to free herself, when she, at once, flew away. The attempts of this unruly male were always resented and interfered with by the other ones, but he was sometimes almost too quick for them, so that, had it not been

for the exertions of the hen herself, he might possibly have been successful. She, however, was not at all inclined to submit to these rough methods.

Thus, continued observation does not show an absolute uniformity in the nuptial methods of the males. The one that I have first mentioned seemed, from my own observations both here and in Sweden, to go beyond the average of pomp and solemnity in his wooing, and I was particularly struck by the wide extent of his circlings, as being well adapted for a full hind, as well as front and side, view. Another was altogether quicker and brisker, nor were his circumambulations anything like so wide or full—in fact, not a marked feature—his appearance, in consequence, being not nearly so impressive, whilst a third threw off form altogether, and resorted to force. The birds, generally, however—all the rest except these last two—were far more on the pattern of the extra formal one. Long before 5 everything was over, and no more hen birds had come to the *lek*. Had I remained quiet perhaps they would have done, but I had to rise and run about, being no longer able to endure the cold—a cold which, though not freezing water, seemed to my sensations greater than that of Sweden, earlier in the year. Possibly the dampness of these English moors, with their dreadful, stealing, chill mists, may account for this—at any rate, I have found it less bearable. I have been without my plaids, indeed, but warmly clad in an ordinary way, and with a motor suit over all—I may here say *en passant*, as perhaps of use, that double trousers, shirts, &c., are, in my experience, warmer than the one, with underclothing; and the two methods are combinable.

Of one other successful courtship, I unluckily saw only the end, and can, therefore, only say, in regard to it, that the same hen had been courted, before, unsuccessfully, by various males; so that here, too, the evidence, though less complete, yet points in the same direction.

To judge by what I have seen, the union of the sexes is, owing to the strenuous interference of rival males, effected with much greater difficulty in the case of the Blackcock than in that of the Ruff. That curious forbearance on the part of the unfavoured males of the latter species, even when quite close, is here very much rarer, even if it exists; but any cock near, as a

rule, darts upon the offending one, and seizing him by the neck, with his bill, drags him to the ground. When two or three males are either courting the same hen, or near enough to intervene, it all becomes one tumble, from which the hen emerges, in sorry plight, and generally, then, flies away. Thus what I have said in regard to the power and position of the Reeve does not apply equally to the hen Blackcock, but though she cannot, with such ease, give effect to her choice, it must still be considered as the governing factor, since each male endeavours to win it, and, failing to do so, must remain a celibate. This, from what I have seen, should be the fate of many Ruffs—perhaps the majority—and, if the numerical disparity of the sexes is anything like what it appears to be, upon these courting-grounds, it may be the same with the Blackcocks, even if the hens are not, any more than the Reeves, confined to one husband. My idea is that, in either case, a select number of the finest males are, year by year, chosen—the taste of the various hens often coinciding—so that the less ornate ones are gradually, as it were, weeded out.

Even more than before, I have, this morning, been struck by the sudden occasional outbreaks of leaping, accompanied with shrill cries—the curious “chu-whai,” strained, as it were, and long drawn out—which, at one and the same time, affect the whole assembly of males. As this has always happened when I have seen a hen come down upon the *lek*, it may have been caused, at other times, also, by one, that I did not observe, flying by, or by her cry, at some distance—perhaps, for me, out of earshot. Although such a sudden, general access of violent springing and crying, with short flights, in some cases, from place to place, over the ground—a sort of revival-scene—is, of course, a very noticeable and arresting thing, making, in its entirety, quite a fine spectacle, yet there is nothing in any individual performance differing from what I have before described, or more nearly approaching to the extraordinary, frenzied dance, of protracted duration, accompanied by repeated and varying cries, generally referred to as if it were *the* feature of these Blackcock assemblies, but of which I have only, myself, seen one instance. Between this and these mere single springs, with, generally, one loud “chu-whai,” there is certainly

a very great difference, as far as effect is concerned, yet it is but of degree; the one is but a development of the other, as it appears to me, a prolongation and accentuation of it, carried to an extreme point. That it springs from strong excitement, for which some active vent has become necessary, is plain enough, and since brought thus strongly about by the mere flying in of the hen—being most in evidence, moreover, during the breeding-season—it must be considered as of a fundamentally sexual character. Still, as it is not dependent, even in its highest degree, on this cause,* it is very probably an expression of martial ardour, also, that and amatory feelings being, of course, intimately associated. But however this may be, it forms no part of the actual wooing, by the male, of the female, which, as seen, is of a totally different character, wherein the special adornments of the one sex are specially displayed before the other. Since, therefore, the “war-dance,” as it has been called, is not specially addressed to the female, that she pays no particular attention to it is nothing to the point, as an argument against sexual selection, though its existence, side by side with the other—that display to which she does pay attention—is, if rightly considered, a very powerful argument for the truth of that doctrine, since only one *possible* cause for the latter seems now to be left.

May 14th.—This morning I went to the old, smaller place of meeting, but have nothing to note, it being an extremely poor affair. There were not more than four cock birds there, at any time, no hens came, and nothing happened, till, finally, I was discovered, which clinched the fiasco. As before, no bird flew in till about 4.15, a full hour later than the others fly in to the great gathering-place. On the following morning I was kept in by the weather, it being both a tempest and pouring with rain. I had, indeed, often emerged upon the dark moor-top, cycle in one hand and umbrella in the other, but there is a limit to everything.

May 16th.—Seated by 3. The melancholy, thin, quavering cry of the Curlew. Then the Lark. First Blackcock down at 3.20. “Chu-whais”—faint at first—whirbling a few minutes

* The “dance” that I saw in Norway was performed by one solitary bird.

later—and this is always the case. Thus the first arrival was some ten minutes after the usual time, and everything else, this morning, both the actions and deportment of the birds, and the diminished powers of their vocal performances, showed a waning energy. But one hen came to stay; another may have flown in, but, if so, soon went again, without being courted. One or two other arrivals, that produced the springing and crying, though not in so high a degree, were not hens, but cocks. The one hen that stayed was courted in the usual manner, one would say successfully, except that the numerous interferences, at the end, seemed also to be successful. So uniformly is this the case that it really seems surprising that fertile eggs should be laid by the females of this species at all.

The above was the last observation which I had the opportunity of making before leaving England.

Having now made a faithful transcript of my notes, which, as far as possible, were made on the spot, and shortly after the facts referred to occurred,* I will endeavour to summarise the results. Darwin was dependent for the facts upon which he based his theory of sexual selection upon the observation of others. This, though defective, in part, was correct, upon the whole, so that his reasoning, which has never been shaken, rested upon a secure basis. In regard to the Blackcock, he appears only to have been told of the frantic part of the bird's behaviour, and assuming, in accordance apparently with the opinion of his informants, that this was addressed to the hen, made his deductions, accordingly, as part of the general case. Substituting for this frenzy, whatever may be its origin, the very different kind of display which I have described, I claim actually to have seen what Darwin believed must take place, in this and other instances of bird courtship. He said that all this great care and trouble could not be taken by the male bird for nothing, but that the female must be susceptible to, and yield to it. I have given

* The skeleton of the drama can generally be entered during some of the *entr'actes*, and filled in on the fall of the curtain. A pencil may even bring down an important fact or two flying, so to speak, and therein is superior to any fountain or stylo. Ideas, too, one may keep pace with in the rough, but their elaboration is for that most blissful of all hearths, the lonely cottage-lodging one.

various cases where, in every way possible, the female showed this susceptibility, and did, in fact, yield to it. Darwin urged also that, as the plumage of the males had become gradually handsomer, as evidenced in various ways, the more ornate birds must have been, in general, preferred by the females, in order to produce this result; that the hen was not, therefore, impressed equally by all males alike, but exercised choice. As it appears to me, I have shown that the hen Blackcock does, in very fact, feel such preference, and exercise such choice, not by general statements to that effect, wherein the conclusion arrived at, only, is given, but not the specific facts which have led to its adoption—the usual method—but by presenting the facts themselves, so that the reader can test the validity of that conclusion, and form his own upon the same data. Of course, if the hen birds choose from amongst the males, and if the latter, as a consequence of this, become handsomer, such choice must be determined by their appearance; but I could not, here, as with the Reeves, actually see the hens thus pick beauty out, since the cocks were all of a feather, and, to my human eye, all looked equally handsome.

My observations, then, as I hold, show that the female Blackcock is affected by the courting display of the male—sometimes so strongly that one may correctly describe her as fascinated—that she does yield to it, and not to force or martial prowess, and that she exercises choice in regard to the various males. They show also that, whilst being courted, she is extremely jealous of any other hen that may approach, and will pursue and fight with such, fiercely. Yet, at the same time, she is often extremely hard to win, and will resist the charm of the cock's allurements, though exhibiting every sign of being strongly impressed, and indeed fascinated by them. Why this should be so I do not know, but the psychology revealed seems more delicate and less simple, nearer to humanity, or more human-seeming, than, even though accepting the doctrine of sexual selection, one might have anticipated. The hens, also, come to the place of meeting with the evident object of being courted, and for that reason only. When the courtship has been brought to a conclusion, either to their satisfaction or otherwise, or should they tire of it, they fly away.

As for the male Blackcocks, they assemble at a special place, in order to court the hens, when they arrive, wait for them to fly in, and court them, then, with as full knowledge of what they mean, and what they expect, as a result of their actions, as could be in the mind of the most wideawake human suitor. They are full of rivalry and jealousy of one another, seem to have a fine martial spirit, but, with all this, "protest" very much more than they fight. Tits, Sparrows, and other unconsidered small birds are, in my opinion, much greater fighters, and a Coot might well sneer at their cowardice. Here, too, as with the Ruff—so it appears to me—something is at work which is sapping the real warlike mettle of the birds, and I believe this to be, in either case, the more important part which display takes in securing the favours of the hen. With birds, as with other animals, including man, pugnacity must be founded upon utility of some sort, so that if charm, in courtship, becomes more and more, and prowess less and less, the former will come to be cultivated at the expense of the latter.

Be this as it may, I personally have not yet seen a fight that was both furious and long-continued—an experience which I hardly know how to reconcile with what one hears and reads—and, no more than in the case of the Ruff, does the hen bird seem won by fighting. Even though a cock should succeed, by rushings and short encounters, in keeping a *champ libre* for himself, he has yet to prepossess the hen, and this, apparently, he can only do through the recognized formal display. Should he—and here, perhaps, we have a solvent power—become engaged with an adversary, for more than a few seconds, his place will be taken, and, in any case, he cannot long delay rivalry, as the hen keeps moving on amongst the various males. Thus his love of combat, in so far as it may exist, is perpetually checked by his desire to get back to the hen; but having seen so many instances where, with nothing to disturb them, two birds have seemed simply afraid of each other, I am not quite so clear as are others as to the extent to which it does exist. The weapon which is principally relied upon, by rival males, for defeating one another's designs, cannot properly be called fighting, and is, indeed, a mean and inglorious one. I allude to those interferences which take place upon the favoured suitor's seeking to benefit from the

hen's choice of himself, and which are so frequent and, apparently, so successful that, as said before, one wonders how the work of generation can go on. That it does, however, would seem to show that such success is more apparent than real.

The most interesting and significant point in these secondary sexual activities,* as one may call them, of the male Blackcock, is, in my view, that they are of two distinct kinds, the formal display before the female, both the object and effect of which are perfectly apparent, and the totally different leaping or "dancing," which, in its most accentuated form, is a highly extraordinary spectacle, but which, as far as I have been able to observe, has nothing to do with courtship proper, and has no special significance for the female bird. If any general conclusion can be drawn from the daily routine of the meeting-ground, as illustrated by the doings of over thirty male Blackcocks, upon as many mornings, then this dance or frenzy, when really deserving of the name, is a rare thing to see, but every bird indulges, from time to time, in a few springs and flappings of the wings—making, collectively, a striking spectacle—and it is obvious that a gradual increase in the number, intensity, and rate of these would add, more and more, to the strangeness of the exhibition till it culminated, at last, in the full access or fury, wherein the bird presents an appearance and utters sounds which it is impossible to give a sufficiently vivid idea of, either with pen, tongue, or pencil. The two, therefore, are the same thing in different degrees of development, the first or slighter degree being what is ordinarily witnessed, and the last, or extreme one, exceptional. But is there any still lower platform, common to the *Gallinæ* generally, or to most, or many, of them, from which the few exalted leaps of the male Blackcock—or even the single one only—may have sprung? Now, when the cock crows, he rears himself upwards, with a sudden jerk, stretching out his neck, and standing, as it were, on tip-toe, whilst at the same time he violently flaps his wings. The common Pheasant does just the same thing, and so does the Blackcock also, when he "chu-whais" merely, sitting in some tree in the neighbourhood of the arena,† which he has not yet flown down into.

* In analogy with the "secondary sexual characters" of Darwin.

† This can be well seen in Norway or Sweden, where the meetings are held in open spaces in the midst of the fir-forests.

In this *generic* action I see the small beginning out of which the "dance" of the Blackcock has grown. The violent upward jerk has been intensified into a spring—still accompanied with the cry and flap of the wings*—which becomes, with some birds, through repetition and acceleration, an extraordinary and frantic performance. Probably its primary character of a defiance, or challenge, to any rival male—as in the crow of the cock—is still retained, but it does not appear to me likely that so violent a pantomime would go, hand in hand, with an increased capacity for actual fighting. More probably some of that energy, which is now expended in the show of the things merely, formerly fed the thing itself—the banner is at the expense of the war. Fighting, without gain, must be a detriment to the species, inasmuch as individuals may be injured or even killed through it, but, on the other hand, some vent for volcanic force is needed, and the best would be one which was, at once, adequate and harmless. Inasmuch, therefore, as the hen is won by beauty, and not by bravery, this pageant, or pantomime, of the male Blackcock may have been evolved in accordance with the above principles. Be this as it may, however, it is neither addressed, nor does it appear to be of interest, to the female bird, but, on the other hand, a totally different and very elaborate form of display, in which she is interested, and by which she is won, is addressed to her, and to her alone.

How do the above facts affect the question of sexual selection? In my opinion, they speak, trumpet-tongued, in its favour, for assuredly, were it superior "vigour" alone that produced the spring-tide antics of the male bird, together with his more brilliant colouring—were they but a safety-valve for sexual and martial excitement—then the Blackcock has *this* in those free and tremendous activities which make no part of his nuptial display to the hen.† Here, indeed, is an outlet for super-

* See *ante*, p. 256.

† No more than in the case of the Ruffs did I see any evidence of the more "vigorous" males being preferred. This idea seems to me quite delusive. Vigour is not a special characteristic of the display, which is pompous and somewhat staid in its character. How, then, is the hen to gain her ideas about vigour? In the "dance" it might be different, but for this she does not seem to care.

abundant energy, called forth by the season, but something more has evidently been required, and that something is the not boisterous and formless but very careful and systematic display, in which the cock bird exhibits all his chief points to the hen. The fact that the latter here plays a quite indispensable part, that the thing cannot go on without her, that she is jealous, even to assault and battery, of other females, during its continuance, and in every way gives the strongest evidence, or rather proof, of its influence upon her, whilst paying, as far as I can discover, no attention to the other, is surely immensely suggestive—I would say, myself, conclusive. There is simply no place for the display of the male Blackcock before the female, if it be not for the purpose of winning her, and my notes show it does win her.

ON THE OCCURRENCE OF *VIPERA BERUS* IN
THE PYRENEES, NEAR SAN SEBASTIAN.

BY EDWARD BRITTEN.

FOR a long time considerable interest has been taken in the Vipers of the Pyrenees, owing to their resemblance both to *V. berus* and *V. aspis*, the former more properly belonging to the North of France, the latter to the South. According to a great authority (F. Latasti), the Vipers of the French Pyrenees are all referable to *V. aspis*. In North-west Spain, however, *V. berus* reappears to the exclusion of *V. aspis*. The Spanish *V. berus* has been regarded as constituting a distinct subspecies (*V. berus seoanei*), on characters which Mr. Boulenger has shown to be inconstant (cf. 'Zoologist,' 1885, p. 373).

The writer has recently taken a specimen from the south-west of the range which presents such a combination of the characteristics of *V. berus*, *V. seoanei*, and *V. aspis* as to make it at first somewhat difficult to classify, and to render its principal features worth recording. Mr. Boulenger gives it as his opinion that the snake should be regarded as a *V. berus*.

It is a female measuring 475 mm. It resembles *V. berus* in general colour and markings, which are somewhat lighter than in most females. Each belly-plate is bordered by a clear white line. The end of the snout is distinctly turned up, though not to the same degree as in a typical *V. aspis*. The supra-ocular shields are less prominent than in *V. aspis*, and more than in *V. berus*; two complete rows of scales between eye and labial shields on the right side and two incomplete such rows on the left. Ventral plates 143, subcaudals 32 pairs.

In addition to the foregoing data it is significant that a small specimen 200 mm. long, with 133 ventral plates and 29 subcaudals, was obtained in the same locality, and agrees in every respect with a typical young *V. berus*. Incidentally the fact is thereby established that *V. berus* occurs on the Spanish side of the Pyrenees. It would be interesting to examine a number of Vipers taken from the hills between Pau and San Sebastian, in order to decide on the range of variation of the Vipers in the Pyrenees, and on the alterations which such aberrant specimens as the one here noticed will necessitate in the definition of the species.

NOTES AND QUERIES.

MAMMALIA.

Common Shrew on Scotch Islands.—With reference to recent notes on the Common Shrew in Islay, I should like to say that, as far as my information goes, although this Shrew is absent from Ireland, Man, Lundy, the Outer Hebrides, and the Orkneys, in all of which the Pigmy Shrew is alone found, it is common on many of the Inner Hebrides, such as Islay and Jura, from both of which I have examined specimens. Its presence on these islands, if not due to introduction, may lead to a modification of Alston's views on the origin of Scottish and Irish mammals, but in view of the recent discoveries of new and unexpected forms in other Scottish islands, such modification is quite natural, and, indeed, inevitable.—G. E. H. BARRETT-HAMILTON (Kilmanock House, Campile, Co. Wexford, Ireland).

Fauna of Lundy Island.—Since my paper on this subject appeared in 'The Zoologist' (1909, p. 441), I have received another specimen of *Sorex minutus* from the island. Of the five Lundy Shrews captured, four have proved to be *S. minutus*, and the fifth (thought to be *S. araneus*) was not critically examined.—BRUCE F. CUMMINGS (Barnstaple).

Weasels and Stoats hunting together.—I have never read of Stoats and Weasels consorting together when in pursuit of prey, and therefore the following account, observed closely by two eye-witnesses, may prove of interest:—On June 14th this year (1910), as my wife and I were sitting in the famous "Valley of the Rocks," Lynton, North Devon, we saw a mixed pack of about fifteen Stoats and Weasels emerge from the loose stones and rocks covering one of the hillsides. In their actions they reminded us very much of hounds hot on the scent. With noses close to the ground they scampered in all directions, pausing every now and again to raise themselves on their hind legs to look around. I imitated as nearly as possible the squeal of a Rabbit in distress, a trick taught me by a keeper to "draw" Stoats. On hearing this both animals exhibited symptoms of excitement, and rushed towards the direction of the sound; but on catching sight of our persons, which we were not able well

to conceal, they turned back to continue their legitimate hunting. Presently we espied what we thought was their quarry, a Rabbit, sitting on a rock some half-dozen yards away from the hunters. Much to our astonishment, the Weasels and Stoats took not the slightest notice of this Rabbit, though coming in almost actual contact with it, and extraordinary as it may seem, the Rabbit turned on three of the Stoats, and drove them away. Twice or more this was repeated. This behaviour on the part of the Rabbit could be better understood had it been a mother defending her young, but the size of the Rabbit, however, was strongly against this theory, as it was not nearly full grown. The Rabbit, after it had driven its enemies away, commenced to eat quite unconcerned, and the Stoats and Weasels returned to their hunting. The piteous squeals of a Rabbit presently told that some* of these bloodthirsty little animals had been successful, and as we walked away we came upon a dying Rabbit, about a quarter grown, breathing its last, with the usual tell-tale bite behind the left ear. We did not catch a sight of the murderer, our presence having no doubt caused it to retire *pro tem*.—GORDON DALGLIESH (Lynton, North Devon).

Common Seal on the Somerset Coast.—Whilst on a visit to Weston-super-Mare, I saw in the shop of a local fishmonger (Coles and Walter) a mounted specimen of the Common Seal (*Phoca vitulina*), which, I was told, got stranded on the shore there, May 10th, 1906. It was killed with a knife. As this species rarely strays so far south its occurrence is perhaps worth recording.—H. E. FORREST (Shrewsbury).

Six Fœtuses in a Whale (*Balænoptera musculus*).—It has not been considered necessary to adduce further evidence as regards this extraordinary instance of abundant procreation in the pages of 'The Annals,' where it has already been noticed by Mr. R. C. Haldane,* who obtained his information from the Norwegian whaling crews working at his own station in Shetland. It seems to me, however, desirable further to authenticate the record from information received as near to the source as possible, as such frequently saves future trouble and confusion. As the subject may scarcely be considered directly associated with the Natural History Annals of *Scotland*, though with a fairly interesting side-bearing upon a previous record in the Ann. Scott. Nat. Hist.,† which related to twin Whale fœtuses—also considered by many whalers a rare occurrence—I believe the most fitting place for such a record to be 'The Zoologist,' and with that

* Ann. Scott. Nat. Hist. April, 1910.

† *Ibid*.

belief I venture to send the following evidence received from Mr. T. E. Salvesen, of Leith, who kindly forwarded the translation. The best Norse reference to the above fact (see Ann. Scott. Nat. Hist. for April, 1910) will be found in the 'Norsk-Fisheritinde' ('Norwegian Fishing Gazette'), p. 40, where the following notice in Norwegian appears:—"It is to be noted as a wonderful natural history occurrence, that upon the 10th July, 1909, a Finner-Whale was brought into the station at Hellesfjord (Iceland), which had no less than six (6) fœtuses inside. As is known, Whales do not usually have more than one calf, although cases of two or three have frequently been observed; a number such as six, therefore, caused considerable notice, and the fœtuses were carefully examined and measured. It was ascertained that three of them had lengths of thirty-four inches, one twenty inches, one eighteen inches, and one seventeen inches. The authenticity of the report has been vouched for by several of the station hands." Mr. Salvesen, to whom, as I have said, I am obliged for the above translation and extract, adds (*in lit.*):—"I also noticed a similar report in the 'Morgenbladet' (the 'Scotsman' of Norway), and in 'Norges Sjøfahrtstidende' (the 'Shipping Gazette' of Norway), so far as I can remember, in August, 1909. I have asked Capt. Bull if he had further particulars to give, but he said there was nothing more of interest. He had no camera nor spirits of wine at the station." This latter sentence was in reply to my enquiry as to whether any of these small fœtuses had been preserved. — J. A. HARVIE-BROWN (Dunipace, Larbert, Stirlingshire, N.B.).

AVES.

A Curious Nesting Site.—On one of the rainy days in May last, a farmer, on going to fetch his sou'wester hat from off a peg in one of his cow-sheds, was surprised to find that the hat contained a nest in the making. He then placed the hat back, and, after watching, saw a Wren going in and out of the shed with material. The nest after a while was finished, and soon contained eggs, and, although it was frequently taken down to show to visitors, the birds never deserted it, and managed to bring off their young ones successfully. — T. OWEN (Pen Parc, Bangor, North Wales).

Lesser Redpoll at Hampstead.—I have found five nests of the Lesser Redpoll (*Linota rufescens*) on the Heath here this year; two were placed in oaks, two in hawthorns, and a fifth high up in a birch-tree. The earliest date on which I found young birds ready to leave the nest was on June 13th. This makes the third year running in

which I have found nests of this bird here, and I mention the fact, as in the only authoritative account of the Birds of Hampstead (J. E. Harting in Lobley's 'Hampstead Hill,' 1889) the Lesser Redpoll is recorded as occasionally being seen here in the autumn only, and no instance is therein given of its having nested at Hampstead up to that time.—H. MEYRICK (The Mount, Hampstead).

Short-eared Owl Nesting in Essex.—Fourteen years ago I recorded a nest of this interesting bird on Northey Island (Zool. 1896, p. 233). For the last month or more we have constantly seen a pair of these birds about on our meadows and marshes, and quite thought they were nesting on our land, but my son, Lieut. T. M. Fitch, and one of my daughters undertook an expedition of discovery when they were at home, and located the nest in a marsh on an adjoining farm, Little South House, half a mile away from Northey. The grass was being cut in the adjoining marsh, and the next evening my son brought back the mangled remains of four young Owls, and the driver of the mower picked up four others in the nest. Mr. Ashcroft, tenant of Little South House, was anxious they should be preserved, but his man mowed over them with the machine inadvertently. The day before yesterday (July 7th) my head horseman brought me a fully-fledged young Owl—a little beauty—that he had caught while ploughing in one of my fields; it was especially lively, but was pinioned, and had a cut on the neck just above its wing. I sent it back at once, and trust that it may live, but doubt if it will ever fly; one old bird is still about every evening, but previously it was very busy all day. At any rate, we can account for nine young ones, but I fear the mother was killed with her family.—EDWARD A. FITCH (Brick House, Maldon).

Supposed Occurrence of the Swallow-tailed Kite (*Elanoides furcatus*) in Surrey.—A stuffed specimen of the Swallow-tailed Kite was on exhibition at the Museum Congress of the South-Eastern Union of Scientific Societies, held recently (June 8th to 11th) at Guildford. I made enquiries about this bird, and the information I received from the local taxidermists, Messrs. W. Bradden and Son, of North Street, was that the skin was brought to them some ten years ago by a cottager, who said that his father shot it some years previously at Chiddingfold. The skin was in a deplorable condition, having evidently been taken off the bird by some one who had no knowledge of taxidermy, and this clearly shows on the bird now that it is set up. The cottager was given a few shillings for the skin, and this was

all the information I could obtain. Allusion is made in 'The Zoologist,' 1897, pp. 270, 271, by Mr. W. Ruskin-Butterfield, Curator of the Hastings Corporation Museum, to the specimen belonging to Dr. Otho Travers, of St. Leonards-on-Sea, shot by his father, Mr. O. W. Travers, it is believed at Mildenhall, in Suffolk, between the years 1830-40; and Mr. G. W. Bradshaw, in the same volume of 'The Zoologist,' p. 270, states that "this specimen was restored by Mr. Bristow, of St. Leonards, and that Mr. Travers, who shot it, told him it was eating a Partridge at the time." The late Mr. Howard Saunders, however, would not include the species in his 'Manual of British Birds,' and in his second edition, p. 338, he writes that "An example of the American Swallow-tailed Kite (*Elanoides furcatus*) was taken alive during a heavy thunderstorm near Hawes, in Yorkshire, on Sept. 6th, 1805, but afterwards made its escape, and there is ground for suspecting that it had previously been in confinement. There are other records of the occurrence in Great Britain of this chiefly Neo-tropical species, but none of these are, to my mind, satisfactory, and the species has never occurred on the Continent."—THOMAS PARKIN.

PERSONALIA.

Presentation to Mr. C. O. Waterhouse, I.S.O.—On June 30th Mr. Charles Owen Waterhouse, I.S.O., Assistant Keeper of Zoology in the British Museum (Natural History), severed his official connection with the Museum, and the opportunity was taken of presenting him with an illuminated address, signed by numerous members of the Staff and others, including Dr. A. G. Butler; he was also the recipient of a desk, a barometer, and a gold watch. The presentation was made by Mr. L. Fletcher, Director of the Museum, who, in the course of a short speech, pointed out that Mr. Waterhouse was retiring from the service of the Trustees after a period of forty-four years, a period of service only exceeded by one member of the Staff of five hundred employed in the British Museum. Reference was also made to the honour lately conferred on Mr. Waterhouse by the King. Mr. Fletcher then read aloud the text of the address before handing it to Mr. Waterhouse and presenting him with the other donations. Mr. Waterhouse, in returning thanks, said how very much he regretted leaving the Museum, where he had spent so many years. He traced the growth of the Insect Room from the modest dimensions of the former Insect Room at Bloomsbury to the fine series of rooms at South Kensington to-day, extending along a frontage of some three hundred feet, and hinted that some of those present

might live to see the Insect Section become an entomological museum. He added that the growth of accommodation for insect collections was accompanied by the increased importance attaching to entomological science, on the perfection and advancement of which so much depended. The entomologist was no longer an individual to be looked down upon. Mr. Waterhouse concluded by saying that he would not say "Good-bye," as he hoped to be able to pay periodical visits to the Museum in future. Dr. Butler made a few remarks in conclusion, reminding those present how long he had been associated with Mr. Waterhouse when he was at the Museum.—G. M-W.

Correction.—I regret I have to correct one or two slips in my paper on "The Formation of Useless Habits in Two British Newts." Page 164, line 16 from bottom, page 172, line 23 from bottom, "stereoscopic" should of course read *stereotropic*. Similarly in the June issue, page 211, line 7 from bottom, page 220, line 2 from bottom, page 221, line 13 from top. "Stereotropism" is a useful word coined to denote direct motor response to surface stimulus. The frequent use of a stereoscope with wild-life photographs must be made responsible for the mistake.—BRUCE F. CUMMINGS.

OBITUARY.

WILLIAM HEARDER.

WE regret to hear of the death of our occasional contributor, Mr. William Hearder, of Plymouth. The following extracts are from a notice in the 'Western Daily Mercury' of July 2nd:—

"It was as an expert in the craft of fishing that the late Mr. Hearder was best known. For a large number of years he had carried on business in Union Street, Plymouth, in succession to his father, the firm of Hearder and Son having been established as far back as 1770. He was one of the founders of the British Sea Anglers' Society, and wrote a good deal on the subject of sea and river fishing in the neighbourhood of Plymouth. He was a regular contributor to the 'Fishing Gazette' and the 'Western Daily Mercury,' and other journals. He was also the inventor of a large number of fishing devices, some of which are manufactured by the firm under patent rights. The late Mr. Soltau presented to Mr. Hearder his famous collection of Trout flies peculiarly adapted for Devon streams, and in recent years these patterns were manufactured by Mr. Hearder, who styled them 'Soltau's pattern.' The deceased gentleman had quite a museum of fishing lures of various dates, and was ever willing to explain to visitors the evolution of modern baits from the oldest and most primitive patterns. He specially studied for many years the perfection of the gear used for pier and jetty fishing. His firm supplied the dredgers, trawls, and gear used by the H.M.S. 'Challenger' exploring expedition, the 'Alert,' the 'Discovery,' and other expeditions. Mr. Hearder himself invented an improved Otter-trawl among other things."

His last contribution to these pages was in 1908, on a "Sea-mouse (*Aphrodite aculeata*) near Plymouth" (cf. 'Zoologist,' 1908, p. 470).

NOTICES OF NEW BOOKS.

The British Bird Book ; an Account of all the Birds, Nests, and Eggs found in the British Isles. Edited by F. B. KIRKMAN, B.A. Oxon. Vol. I. T. C. & E. C. Jack.

It may be asked, Why another book on British Birds? In the present case the answer is a very satisfactory one, for this publication is designed and promoted on advanced principles—in fact, although descriptions and figures leave little to be desired as means of identification, the main object is to study the birds themselves as sentient creatures. We have travelled far since the time of popular opinion that the song of birds was provided for the delight of man, as the stars were placed in the firmament to light his way by night. Even quite recently ornithology has been envisaged by two new factors—photography rather than the gun, and “bird-watching” in place of arm-chair conclusions, while both of these have already produced, and are still producing, a revolution in our knowledge of bird-life. In these volumes we are promised a digest of bionomical records published during many past years, read at the time, and often subsequently forgotten; the pages of ‘The Zoologist’ alone will afford an illuminative example. The work is to be published in twelve sections or volumes, and the chapters often restricted to a genus and treated by different writers.

A prominent feature in the volume now before us is the supplementary chapter on “The Finches,” by that prince of bird-watchers, Edmund Selous. Here we revel in original observations, and as readers of ‘The Zoologist’ well know, if Darwin’s theory of Sexual Selection is to be revived and maintained, it will be largely owing to the work of its enthusiastic apostle, Mr. Selous, who seems to have accepted a mission to prove and advocate it. His hardly earned facts would have been gratefully received and used by Darwin himself had such a personal synchronization been possible, but after all theories

are to be valued for their suggestive stimulus to future workers rather than to be accepted as dogmas of an evolutionary creed. In the study of organic evolution we might accept the foreword of the 'Hibbert Journal': "We stand for three positive truths: that the Goal of thought is One; that thought, striving to reach the Goal, must forever move; that in the conflict of opinion the movement is furthered by which the many approach the One."

It is announced that the complete work will contain two hundred coloured plates, and many in monochrome. Those in the present volume have reached a no inconsiderable standard in excellence. We do not expect this publication to be absolutely infallible—that is a literary impossibility—but it has certainly apprehended a want in animal bionomics, and undertaken a work of which the open door had long been disregarded. How the scheme will be elaborated succeeding volumes will alone prove; this one at least has laid a good foundation.

A Handbook of the Birds of Tasmania and its Dependencies. By FRANK MERVYN LITTLER, M.A.O.U. Published by the author at Launceston (65, High Street), Tasmania.

THIS, which we believe is absolutely the first book to treat of the birds of Tasmania as a whole, is written and published by Mr. Littler at cost price, and for a few shillings, at his own risk and initiative, and we trust that his enterprise will not entail the usual results; it certainly does not deserve to do so. Some two hundred and fourteen species are fully described, and also the nests and eggs of the birds as well, with many useful and interesting observations. The fauna has its distinctive peculiarities. "Of the species 'peculiar' to the island, all save the Lesser White-backed Magpie (*Gymnorhina hyperleuca*) are larger than their nearest allies on the mainland. A number of species lay four or even five eggs to the clutch, while the same species or related ones on the continent of Australia lay but three. There are also a number of structural differences in the nests of several species as compared with those across the Strait, but this point is not emphasized as much as the preceding ones, nor

is it as important." The Snipe (*Gallinago australis*), although scattered over a wide area, is nowhere plentiful, and, as stated by Colonel Legge some twenty-five years ago, is decreasing in numbers. The conditions, according to Mr. Littler, are now far worse than they were then, and sportsmen complain that some years they never see a Snipe. "The whole thing is very puzzling, for there are still a number of localities ideal in their way for Snipe—localities where the birds would be very little disturbed." We could add numerous other bionomical facts of equal interest if space permitted and we wished to pillage this volume, a course, for both reasons, which we cannot pursue.

The illustrations are numerous and excellent; no longer the artist's set up of birds as seems to him befitting, but photographs of nests and breeding haunts, taking us straight to nature and away from the glass case and museum limitations. Mr. Littler should feel quite satisfied with this faunistic contribution, and doubtless his book will reach many ornithological shelves.

A Synonymic Catalogue of Orthoptera. By W. F. KIRBY. Vol. III. Orthoptera Saltatoria (Locustidæ vel Acridiidæ). Published by the Trustees of the British Museum.

THIS thick and most useful volume completes Mr. Kirby's general Catalogue of the Orthopterous Insects of the World, and may be taken as the last of the official work of the author at the British Museum, for Mr. Kirby has reached the age at which the departmental guillotine gently severs official engagements, and relegates its old servants into the well-earned retirement of private life.

This Catalogue is written on the best moderate conservative lines. All errors known to the author have been carefully corrected, but no endeavour has been made to turn the subject topsy-turvy by an unnecessary resuscitation of names long since dead and buried, or by changing the classificatory arrangement on personal idiosyncrasies as frequently seems the one thing needful in some modern works of a similar nature. Mr. Kirby's great knowledge of entomological literature unusually equips him for these compilations, and he is to be recognized as the veteran writer of entomological catalogues on the synonymic

method. Errors there must be, and the best catalogue is one in which these are fewest; to break the ground is work of the pioneer, as is largely the case with this publication, and it greatly assists the student, and what is more, though of far less value, gives scope and action to the uneasy soul of the critic. We believe that these volumes will do as much for the study of the Orthoptera as the same author's 'Synonymic Catalogue of Diurnal Lepidoptera' (published in 1871) did for those who worked at exotic butterflies. But after all no one can properly appraise the value of a catalogue till he has used and worked with it for some period of time; reviews and criticisms on these works when first published, often by writers unfamiliar with the particular phase of animal life to which they refer, must necessarily be very near the realm of bathos. That, however, these three volumes of Mr. Kirby will maintain their standard with orthopterous students is the conviction, at least, of the writer of this notice.

EDITORIAL GLEANINGS.

NATIONAL BIRD AND MAMMAL RESERVATIONS IN ALASKA IN CHARGE OF THE U.S. DEPARTMENT OF AGRICULTURE.—Seven reservations for the protection of birds and mammals in Alaska have been set aside by executive order and placed in charge of the Department of Agriculture. These reservations, created in February and March, 1909, comprise, with one exception, small islands at several points along the coast of Alaska and in Bering Sea, as follows:—Bering Sea Reservation: Saint Matthew, Hall, and Pinnacle Islands. Fire Island Reservation: Near head of Cook Inlet. Tuxedni Reservation: Chisick and Egg Islands, Cook Inlet. Saint Lazaria Reservation: Saint Lazaria Island, Sitka Sound. Yukon Delta Reservation: Tundra of the Yukon Delta. Pribilof Reservation: Walrus and Otter Islands, Bering Sea. Bogoslof Reservation: Bogoslof Islands, Aleutian Archipelago. Fire Island is the breeding ground of the Alaska Moose; the islands in Bering Sea contain rookeries of Sea-Lions, and all of the reservations are important breeding grounds of Sea-birds or Ducks and Geese. All of these species are protected by the Alaska Game Law (35 Stat., 102), and the birds on the reservations are protected by Act of Congress, signed THEODORE ROOSEVELT, under date, Feb. 27th, 1909.—(U.S. Dep. Agric. Bur. Biol. Surv., Circular No. 71, 1910.)

PRIVATE GAME PRESERVES AND THEIR FUTURE IN THE UNITED STATES—HISTORICAL.—The game preserve in the form of a Deer-park as an adjunct to a private estate dates back to the earliest colonial days. One of the first, if not the first, in America was located in Maryland, on the eastern side of Chesapeake Bay, near its head. Augustin Hermann, a cartographer, born at Prague, Bohemia, in 1608, came to Maryland in 1659, and surveyed and mapped the province, a service for which he received a grant of land in Cecil County. Here he founded, in 1661, the manor of Bohemia, and among other attractions added “a large Deer-park, the walls of which are still standing.”* In the descriptions of colonial estates, particularly those in Maryland and Virginia, frequent references may be found to Deer-parks.

* Wilson, J. G., ‘A Maryland Manor,’ p. 15, 1890.

In 1753 Benjamin Tasker, the Governor of Maryland, on retiring from office, laid out his country seat Belair, near Collington, Prince George County, in true manorial style, and included in the improvements a park for Deer.

Another celebrated estate in Maryland was that of Harewood, on Gunpowder River, near Baltimore, which about the year 1830 included a Deer-park of some three hundred acres, where "two hundred Deer may often be seen at a single view." Here experiments were made in introducing Pheasants, European Quail, and Red-legged Partridges, but proved unsuccessful, owing chiefly to depredations of poachers and natural enemies. Thirty years later, about 1858-59, was established the Deer-park of Judge J. D. Caton, near Ottawa, Ill. This park, which originally comprised but forty acres and was afterwards increased to two hundred, was the first of its kind in the United States. It was established solely for the purpose of observing and studying the various kinds of big game in a state of captivity. Here the observations were made which formed the basis of the owner's well-known work on the Antelope and Deer of America.

The first game preserve belonging to an incorporated association was that established by the Blooming Grove Park Association in 1871, for the purpose "of preserving, importing, breeding, and propagating game animals, birds, and fish, and of furnishing facilities to the members for hunting, shooting, and fishing on its grounds." One of the important features was a Deer-park. This venture was followed a few years later by numerous other parks of various kinds, until they now number several hundred.—(U.S. Dep. Agric. Bur. Biol. Surv., Circular No. 72, 1910.)

MR. JAMES DRUMMOND, in his "Notes on Natural History in New Zealand" (the 'Lyttelton Times,' June 4th, 1910), writes:—"Omaui is the name of an islet at the entrance to the New River Estuary, the approach to the port of Invercargill. The part of the island which faces the ocean and Stewart Island is comparatively flat, and is entirely in the possession of Sea-gulls. The part which faces the north and Invercargill is high, and is covered with veronicas, mosses, lichens, and small tussock. This is the home of countless thousands of Terns. They breed on the highest part, on the Riverton side, and their breeding-place, according to the account supplied by a recent visitor, is a sight that is worth seeing. He says that when he visited the crags and picked his way amongst the eggs, he had the utmost difficulty in avoiding trampling upon them. It is hardly correct to

say that there are nests, as the egg is nearly always laid on a flat rock, under a tussock, or in a crevice of the rock. It is often not more than three inches from the edge of a crag, and it is surprising that the eggs should escape being blown away in rough weather. When the birds are disturbed they rise almost simultaneously, with a continuous shrill call, and make a circuit in the air, presenting an extraordinarily regular and drilled appearance. As they fly over the visitor's head, he seems to be looking through a wonderful transparency of snowy-white wings and reddish legs, relieved by shining black heads. 'It is hardly possible,' the correspondent writes, 'to imagine a more strikingly beautiful sight.'"

FISH KILLED BY LIGHTNING.—In these islands we seem to escape the severe thunderstorms which work havoc in the larger areas of Europe and America. The 'Oesterreichische Fischerei-Zeitung' records two instances of the destruction of fish by lightning. At Neuhaus, in Austria, a tank belonging to Count Czerninschen, and containing about 15 cwt. of Carp, was struck by a thunderbolt, every one of the fish being destroyed. The same thing occurred in a mill-stream near Passau, where a large number of fish, including some magnificent Pike, were killed by lightning.

The 'Deutsche Fischerei-Zeitung' records a curious instance in which a tree on the banks of a pond near Orsoy, on the Lower Rhine, was struck by lightning. The pond happened to be in flood at the time, and the whole of the ground surrounding the tree was under water. A number of fish, weighing 20 lb. in all, were afterwards found floating in its immediate neighbourhood. The cause of death in every instance was rupture of the swimming bladder.—(From the 'Fishing Gazette,' Sept. 12th, 1908.)

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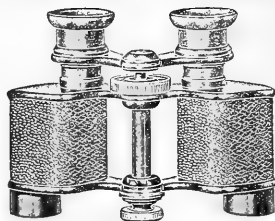
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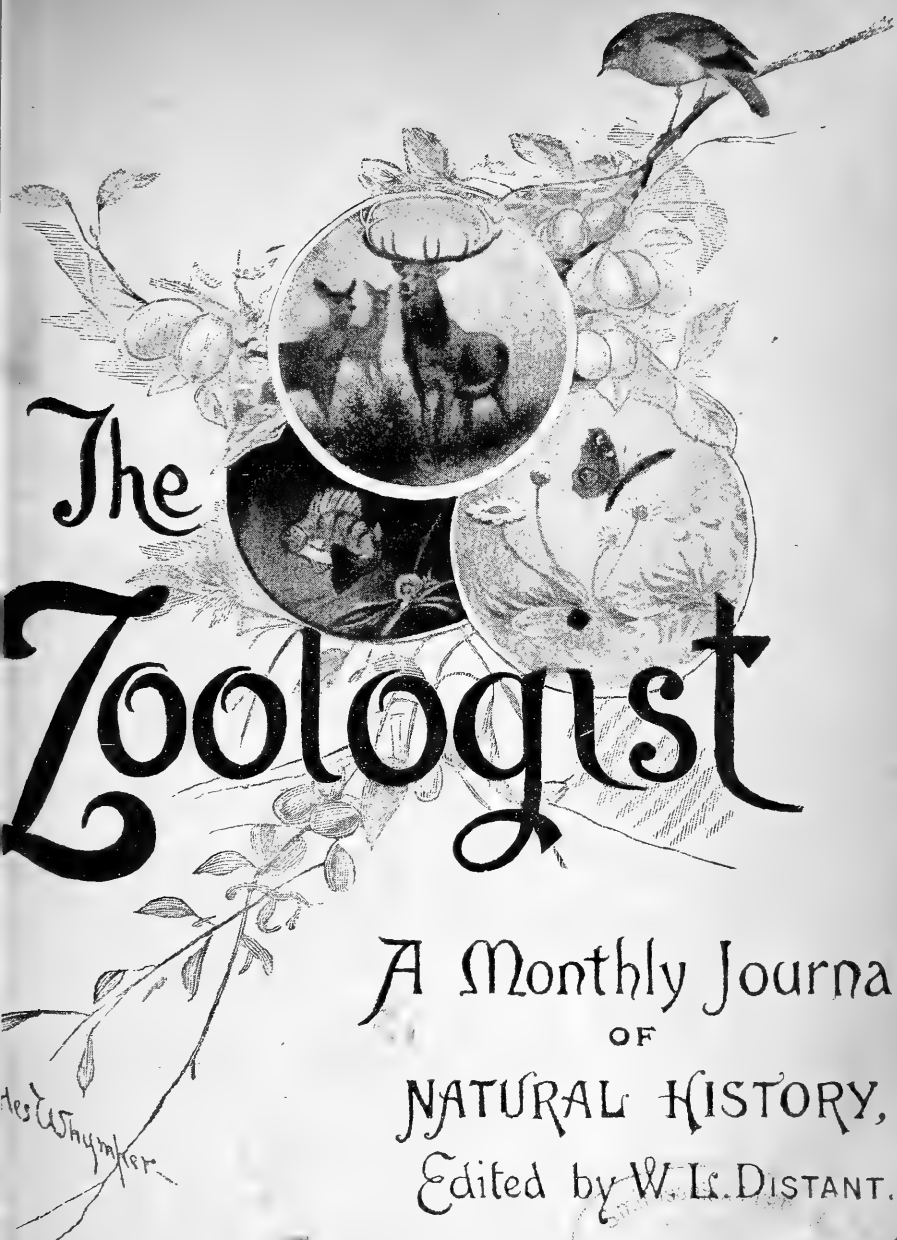


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THE ZOOLOGIST

No. 830.—*August, 1910.*

NOTES ON THE ORNITHOLOGY OF OXFORDSHIRE, 1909.

BY O. V. APLIN, F.L.S.

January 1st.—Slow thaw; snow wasting slowly. A number of small birds reported picked up dead round ricks lately.

5th.—No Thrush song since frost set in at end of last year.

6th.—A Nuthatch (now a rarity here) again frequents the old plum-tree here to hammer food. Only a few nutshells under the tree, but many acorn-shells. I heard it “trilling” a few days ago.

10th.—Great, Blue, and Coal-Tits are constantly visiting the fat hung up for them, but the Marsh-Tit I never see. The last-named is a seed-eater or a “nuttist,” and comes about my garden a good deal in the autumn. In winter its favourite haunt is the vicinity of beech-trees.

11th.—Blue Tit singing; Coal-Tit with spring note.

17th.—An ordinary snowdrop in bloom.

20th.—A Song-Thrush singing. Hardly any about since the frost.

21st.—Received a Short-eared Owl, shot on the 19th, from a rushy meadow at Chadlington. Two Thrushes sang despite the fog.

23rd.—Mr. Tyrrell reported later that great numbers of Bramblings (consorting with Chaffinches, Greenfinches, and Sparrows) were noticed this month at Deddington, Swerford, South Newington, &c.

28th.—Saw, at Mr. Bartlett's, an immature male Merlin, shot at Tusmore in the early autumn of last year. A Grey Crow reported as seen recently at Sibford.

A Black-headed Gull and a Common Tern were, Mr. Tyrrell tells me, shot on the canal near Banbury this month, and sent to him to preserve.

A rather dry, cold month ; hard frosts in the latter part.

February.—Spring flowers very backward.

4th.—Mistle-Thrush singing. Few Song-Thrushes about yet.

5th.—Flock of two or three hundred Bramblings and Chaffinches on a ploughed field at Milcomb. The former were in the majority, and among them were a good many males with dark heads and mantles and white rumps. Fieldfares and Redwings continue rare.

6th.—During a long afternoon after the Basset hounds I did not see one of those birds. A good many Song-Thrushes have returned. Lark singing for first time since late autumn. A flock of about a score of Corn-Buntings on north side of Wroxton, where they are always to be found in the breeding season—a most local bird.

9th.—Encouraged by a slight snow and rain, a Blackbird sang. Hedge-Sparrow sings now.

10th.—Nuthatch feeding on fat.

14th.—I put twelve nuts in the Nuthatch-frame between 11 and 12 a.m., and found, at 3 p.m., that they had all been taken. I think the birds hide most of them for future use when they find a good supply.

15th.—Four Bullfinches in a plum-tree at the same time—poor buds !

17th.—Crows go about quietly in pairs now, unless two pairs come together. Chaffinches sang a little. Country very dry.

19th.—An Otter which has been about all the winter was shot at Upper Grove Mill to-day.

20th.—Severe weather. A very large flock of small birds comprised House- and Tree-Sparrows, Yellow Buntings and Greenfinches, with a few Chaffinches and Bramblings.

21st.—The pair of Nuthatches we have here picked up from the ground in front of my window a big handful of nuts in less than a quarter of an hour ; most, perhaps all, of these

must have been hidden. They hide them in old thatched roofs.

22nd.—Very little song of any kind, except from the hardy Hedge-Sparrow.

27th.—Frost and snow, but a Blackbird sang a little; no Thrush song for some days. No Wren song all the cold weather this month, and the Wrens I have seen look fluffed up and dejected. Although cheery and bright in the early part of a frost, however severe, I doubt now if the Wren is a very hardy bird. If the weather is cold it does not sing at *this* end of the winter, and its habit of roosting in company in old nests and holes shows that it feels the cold. A Herring-Gull shot at Somerton this month (Tyrrell).

28th.—Milder. A Wren sang.

A very dry (less than half an inch of rain) and a cold month. Frost on twenty-five days.

March 2nd.—The Hedge-Sparrow's tarsi (male at all events) now are a dull beefy-red, and it walks as well as hops.

3rd.—Lots of birds feeding outside the window. The Greenfinches will pick up corn eagerly.

13th.—Spring flowers a complete failure so far. A *Turdus* nest partly built in a sheltered yew-hedge—a lot of old snow lies on the north side of the shrubbery. Comparatively few Thrushes about.

16th.—The high ground about Tadmarton Heath is still a good deal covered with snow, and the hills at the back of Swallowcliffe and all along towards Sibford Heath and Epwell are white. A Peregrine flew over a belt of trees at the Highlands, a Rook giving a grievous croak as it went over.

19th.—The first night without frost for weeks.

21st.—A Blackbird's nest in the yew-hedge has one egg; the other nest has been abandoned.

26th.—A little apricot-blossom.

30th.—Peewits on fallows.

Very cold up to the 19th. Frost on twenty-three days, and snow fell or lay on ground on seventeen days.

April 3rd.—Tawny Owl (breeding) hoots rarely now and then in a soft tremulous way; not with the volley of high clear hoots we hear on cold moonlit winter nights.

5th.—Brimstone Butterfly in garden. A late spring.

6th.—Two Chiffchaffs in song in Milcomb bushes. A new Crow's nest (five eggs on 27th). Country quite wintry looking.

7th.—A Swallow over the garden. Several Brimstone and Tortoiseshell Butterflies have been seen, and I saw that a Tortoise in a neighbour's garden had emerged to-day.

8th.—Two Swallows together over garden, singing.

9th.—Hedges black, country wintry and dry. Greenfinch singing.

10th.—Several Swallows.

16th.—Redstart. Magpie's nest with five eggs.

19th.—Cuckoo noisy. Tree-Pipit. I never before saw Swallows here *in numbers* so early.

20th.—House-Martin. Willow-Wren.

24th.—Lesser Whitethroat.

25th.—Song-Thrushes have suddenly begun building; three, if not four, nests have been put up in the garden during the last day or two. Clutch of five Crow's eggs brought in.

26th.—Blackcap.

27th.—Away until May 1st. Clutch of three hard-sat Crow's eggs brought in.

Frost on twelve days, snow on two; over two inches of rain fell, chiefly in the latter part of the month.

May 1st.—A little snow and heavy rain.

2nd.—A male Nightjar flew in the face of a man on a bicycle between here and Banbury to-night, and was captured; I saw it later.

4th.—Swifts.

8th.—A Quail (heard since 3rd and picked up on 6th) brought from Adderbury (*vide Zool.* 1909, p. 469).

9th.—It was reported in the 'Oxford Times' of the 22nd that to-day three pairs of Redshanks were seen at the old spot below Eynsham, and three Common and one Black Tern close to Oxford.

11th.—Moths flew in at window at night. At 11 p.m., calm and starlight, I heard Whimbrel passing over.

12th.—Cinnabar month. Fine warm month so far, and, as it proved, May afforded the best weather of the year. Left home until 27th.

28th.—Young Starlings out of the nest.

June 2nd.—A Linnet has a nest (six eggs eventually) in an Irish yew in the garden, so exposed that anyone passing on the path can see the bird, and so insecurely fixed that it slipped down on one side, and the young had great difficulty in keeping in it until they were ready to leave. Five were reared.

5th.—Young Starlings now in considerable flocks, and frequent oak-trees partly defoliated by caterpillars.

7th.—Turtle-Dove's nest in hedge with two eggs was remarkably slight—only a few rootlets for lining, and the eggs showing through very plainly. A Blackbird sang from the barn-roof ridge, and often did so afterwards; but this is a new habit here.

13th.—Redstart has five eggs in a box. This bird has been strangely scarce of late. The young in the nest perished—I think of starvation, in consequence of the most inclement weather.

15th.—To Bampton, and on this and the next day made the following notes:—I found that the Redshank had established itself as a breeding species in this part of the Isis valley since I was here last, and below Tadpole Bridge I saw two pairs and an odd bird which probably had a mate not far off. They were, I have no doubt, breeding, but the great seas of hay-grass would make a search difficult. One pair seemed from their actions to have young hidden in some hay-grass, but they themselves usually settled in a rough thistle and rush-grown meadow on the opposite bank, because it had been grazed and was bare; the low flood-bank, too, was a favourite perch for them, and along it they ran in an excited manner. Their familiar cries, "teur-y, teur-y-leur," drew my attention first, and soon the birds were flying overhead, "kipping" in an excited way, sometimes settling to run a few steps; then into the air again, and flying round, crying almost incessantly. These breeding Redshanks are a great addition to the avifauna of the Isis valley. In this calm sunny evening nothing could be prettier than their grey and white plumage and red legs set against the full rich green of the meadows, thickly bedecked with buttercups, of this lush, luxuriant valley. Peewits were pretty common, feeding at the shelving edges of the river, and there were already flocks in the grazed meadows. Moorhens' chuckles and Dabchicks' rattling cries

sounded from the thick, high growth which generally borders both banks, and makes the river itself very private for the birds, for boats are very infrequent on it. There are a few Wild Ducks too, and Herons are often seen—one came close to me by mistake! I heard only one Corn-Crake in all those miles of hay-grass. Reed-Warblers I noticed in three places in willows, and not distributed evenly along the banks—though there are reeds—like the Sedge-Warblers and Reed-Buntings. The Dabchick must be quite numerous, to judge from their frequent cries, and (although I had to propel as well as steer my boat, and the river winds), I found three nests, two with single eggs, one covered and the other (looking new-laid) not; the third nest had two downy young just out, and two hatching eggs. Moorhens have their nests on the inner side of this belt of rushes and other water-plants—the iris and the great water-dock both very fine—where they are easily seen from a boat. A row of pollard-willows was inhabited by Tree-Sparrows, whose noisy, shrill cries caused me to land and find a nest just being built, of rather green materials. Carrion-Crows, sitting on a fence at a sluice-gate or flying low over the grass top, are common in the valley, and no doubt keep the wildfowl down. Quite a feature of Bampton itself was the bunch of Swifts, which in the evening, and at 3 a.m. too, were swinging round, low down, the little open space in the town, “swee-ree”-ing loudly.

17th.—News from Mr. Calvert of two Little Owls shot at Witney last winter, and of one put out of a hollow tree at Pudlicote on the 19th of last month.

19th.—Garden-Warblers had young just out of the nest; the latter was just dry grass and a slight affair. Cuckoos and Turtle-Doves common this year, and the former still in good song. Mr. Noble tells me that in Hennerton meadows, close to the river, he saw three adult Lesser Black-backed Gulls and two Herring-Gulls fly over within sixty yards. It was early in the month and blowing hard from S.E.; a curious time of the year for adult Gulls to be inland.

24th.—My brother heard a Corn-Crake at Willscote Hill.

25th.—Not over 49° all day; wintry, dismal weather; a cold thick mist last night. Everything is overgrown and spoiling for want of sun.

29th.—Low part of village flooded.

30th.—Examined in the flesh a Little Bittern picked up at Somerton (*vide* Zool. 1909, 468).

A cold, wet month, about four and a half inches of rain, which fell on more than half the days of the month; wind usually from N. and N.W.

July 1st.—Hay-meadows in the Cherwell Valley standing in flood water—to be seen among the long grass. At the end of June or early this month Mr. Calvert saw and heard “drumming” Snipe at Minster Lovell (*vide* Zool. 1907, 325).

9th.—Cuckoo heard for last time.

10th.—The decrease in the numbers of our breeding Starlings is very apparent. Not one nest on these premises this year. It was in the years 1902–3–4 that they reached their greatest strength; in one of those years every box big enough (even within four or five feet of the ground) and every hole under the thatched eaves of buildings was filled; and the new painting in the yard ruined by them!

14th.—Starlings feeding young in nest in roof of the G.W.R. station at Banbury: there has been no “run” on nesting-holes this year, and this must without doubt have been a second brood. It is too late to be a brood reared by a pair which had merely lost their first eggs.

22nd.—Young Bullfinches just out of nest have a wheezy, creaking “peep.”

27th.—A great rain—nearly an inch.

29th.—Report of Red-backed Shrikes having bred in Banbury Cemetery, and of the scarcity of Nightingales, Redstarts (especially) about Swerford. All the Warblers and most of the summer birds, except Swallows and Martins and Cuckoos and Turtle-Doves, are very scarce. Redstarts have been remarkably scarce for two or three years.

A cool and wet month, often windy. Wind generally in the west, and nearly four inches of rain.

August 4th.—A female Red-backed Shrike close to Bloxham Station.

7th.—Congregation of Martins and some Swallows on house roof this morning.

8th.—Garden-Warbler sang; this garden has lately been

full of them, eating the fruit. Thrushes have sung continuously so far.

9th.—The bulk of the Swifts gone. The hottest day of summer (77°) so far.

10th.—Saw four Swifts. I suppose their young ones were starved, and so having none to rear they have gone early. I never saw any number in the air together at the time the young should have been on the wing.

12th.—Two Swifts. Thrush sang morning and evening. 81° .

14th.—House-Martins have had a good breeding season; there are many about.

15th.—Some fifty or sixty Starlings rose at once from my gooseberry bushes! At 5 a.m. I heard Gulls calling as they passed over, going west. 81° again. From the 3rd to the 17th, when there was a great rain, we had the only summer weather.

25th.—Martins congregating on roof.

Nearly two inches of rain—on fifteen days. Wind generally N.W. A late harvest, but most of the wheat cut by the end of this month.

Birds have sung late this year. Blackbird occasionally down to Aug. 3rd. Thrush continuously to the 15th. Greenfinch to the 24th. Robins began to sing again about Aug. 11th.

September 1st.—Shooting delayed by standing oats, barley, and beans. A flock of about a hundred Peewits in some thin swedes.

3rd.—A great many Martins on the roof.

5th.—A Peacock Butterfly. A most fruitful year, but all spoilt by bad weather.

8th.—News from Mr. Fowler of Hobbies seen nearly every evening waiting for the Swallows going to roost in the osier-bed at Kingham.

10th.—Report of three Land-Rails shot about Sibford Heath on 7th. I strongly suspect that Dartford Warblers inhabit a piece of scattered gorse near here. To-day I heard notes and saw a bird, both of which appeared to right, but I had no glasses and could not be sure.

15th.—No Pipits seen yet in the few roots I have walked.

16th.—Swallows with young in nest in stable.

17th.—Severe thunderstorm and heavy rain; extended over

a good deal of the country and much damage done by lightning and, in some parts, hail.

18th.—Report of two Land-Rails shot and another seen at Milcomb on 14th. A small flock of Meadow-Pipits.

19th.—Starlings catching flies high in air. A diminution of Swallows and Martins.

20th.—Flock of Mistle-Thrushes in grass field.

21st.—A big gathering of Martins and some Swallows.

22nd.—Brimstone Butterfly.

24th.—Several small charms of Goldfinches about thistly fields on South Newington Hill. Lark singing.

25th.—A young Song-Thrush sang in an undertone.

26th.—Only a small gathering of Martins on roof; a lot gone. Few Pipits seen yet. Not such a bad season for Partridges here as in some districts. What birds we find are big and strong, and there are some big coveys. We find no late broods. Some birds must have bred early, and the young were strong before the bad weather came. The later broods probably all perished. Red-legged Partridges very scarce.

30th.—Cherwell Valley heavily flooded.

Over three inches of rain; fell on more than half the days of the month. Wind chiefly north. A late and delayed harvest.

October 1st.—Long-eared Owl in spinney at South Newington Hill. Mistle-Thrushes still in small flocks, but some screeching about the hedges. Country deplorably wet. Corn rotting on the ground.

17th.—About twenty Swallows and Martins over garden.

19th.—Brimstone Butterfly.

21st.—Some Pipits; on the move. No longer see many Mistle-Thrushes about. Lots of barley and oats out.

24th.—A Blackbird has sung for some days in a low tone—evidently a young bird. Part of village flooded.

27th.—Caterpillars have destroyed a great quantity of the cabbage tribe lately.

A very wet month; warm until the last week of the month when frosts set in, and snow fell on 30th. Nearly three and a half inches of rain, on twenty-seven days. S.W.

November 1st.—A good many Fieldfares and some passing over. One Redwing.

8th.—Much barley still out and some not cut.

10th.—Many Redwings. Larks sang in first few days of month ; silent now.

11th.—News of a Hobby shot at Hanwell in June.

12th.—Song-Thrush sang well this evening. This is the opening of the usual spell of song, which would go on here all winter if the season were very mild.

13th.—A Lark sang a very little.

14th.—Snow.

18th.—Wren still sings.

23rd.—A Nuthatch here ; only one since February.

28th.—Song-Thrushes sing well, but not many here this autumn.

A good deal of frosty weather this month from the 6th onwards. Rain on thirteen days only amounted to about .70 in., but air damp. Wind N.W.

December 3rd.—Enormous flocks of Starlings here now. A great many Redwings, many Fieldfares, and swarms of Larks and Finches on the stubbles.

4th.—The fruit on three or four plum-trees was not gathered, or hardly any of it. Much of this now remains, brown and shrivelled, on the trees, and affords food for Thrushes, &c. Some damsons left on a tree have not yet been eaten. Greenfinches now feeding on the berries of *Cotoneaster lelandi* and the hips of sweetbriars ; they will stay in the garden in numbers so long as the latter last.

5th.—Aconite in flower, not quite turned up ; the earliest I ever saw. Snow on ground early.

7th.—Thrushes and Blackbirds eating the damsons.

10th.—From 9.30 a.m. for an hour (when I had to leave) Fieldfares were passing over (W.N.W. to E.S.E.) in straggling loose flocks of twenty or thirty to fifty or sixty, at short intervals, and at their usual height. I did not go out until 9.30, so I do not know how long the flight had been going on, nor how long it lasted. But I found later a great many in flocks feeding in the big hedges which are red with haws ; and a lot of Redwings too. There was a change to milder weather last night.

11th.—Wren sings sometimes, but the cold has practically silenced the Thrushes.

14th.—Mistle-Thrush sang a little.

18th.—Hedge-Sparrow sang for first time since summer.

22nd.—Starlings feeding greedily on holly berries. Weather frosty the last ten days or so, but changed to-day.

28th.—Very warm day. Two Larks sang about noon. Coal-Tit with spring note for some days. Thrushes nearly all gone. A Redshank shot on the Cherwell close to Banbury, and sent to me two days later. Bullfinches abundant this winter.

31st.—Mr. E. Tyrrell writes: "Several flocks of Wild Geese have been flying over here [Banbury] these last few days, flying low down." The very few Song-Thrushes we have left sing a little.

Rain on twenty-four days, amounting to over three and a half inches. Air damp. Wind S.W., but slight snow more than once, and frost on ten days; the lowest temperature 20° on 21st.

The great immigration of Crossbills does not seem to have affected this district, where we have few conifers. The following records must be added to this report:—

Aug 5th. Flock of about twenty at Henley (? Berks), end of August. A few at Reading (Berks). Nov. 5th. Flock of nineteen, Shotover, Oxford. Nov. 11th. Small flock, Cuddesdon. Nov. 17th. Small flock flying over Oxford. ('Science Gossip,' December, 1909, p. 406.)

Flocks first seen at Cornwell on Sept. 2nd and onwards until January, 1910, when their numbers appeared to decrease; the last time they were seen was on February 16th. (F. W. Stowe, 'British Birds,' 1910, p. 332.)

But Mr. Fowler wrote on March 25th, 1910, that there were still Crossbills at Cornwell, scattered about and possibly nesting. A pair were believed to be nesting just behind Cornwell House. Mr. Fowler had watched one, two or three days before, at work on larch-cones close to Cornwell village, and others had been seen (*in lit.*).

COMPARISONS OF OTOLITHS FOUND IN FISHES.

BY COLONEL C. E. SHEPHERD.

FACTS in connection with otoliths are unfortunately not recorded in sufficient numbers to make it possible to use such facts for any deductions as to the uses of these stones being made, even if it be eventually found that such deductions could be made. It would be well then to record facts, as they become known, connoting the life habits of a fish and its otolith, and to compare, when possible, the size of these stones in different fishes, more especially when their habits are similar, and even when totally dissimilar. Again, the otolith, whilst maintaining its family resemblance, is yet so different in different families that this lends further interest to the subject.

In a former paper* it was pointed out that the size of the fish established no corresponding rule that its otolith would be larger or smaller than that of another fish of a different family, but of a larger or smaller size. The Smelt, *Osmerus eperlanus*, has a larger otolith (Plate I. fig. 13), though it is a smaller fish, than that of *Auxis rochei*, fig. 2, on the same plate. The plate shows the otoliths, natural size.

This comparison as to the size of the otolith with the size of the fish, although sufficiently obvious in the above-mentioned case, hardly admits of definite accuracy, but is rather one that strikes the eye when dissecting out an otolith—*e.g.* the otoliths in Plate I. fig. 1, from a *Pelamys sarda*, which was 28 in. long, and fig. 2 from an *Auxis rochei* that was 24 in. long, are, the first comparatively and the second actually, smaller than the otoliths of a Flying-fish (*Exocoetus pœcilopterus*) that was about 8 in. long. It is in this manner that all the comparisons as to size in this paper are made. As another contrast, we have those of the Horse-Mackerel, *Caranx trachurus* (Plate I. fig. 7), and the Bass, *Morone labrax* (Plate I. fig. 8); these fish have large otoliths,

* In 'Knowledge and Illustrated Scientific News,' March, 1909.

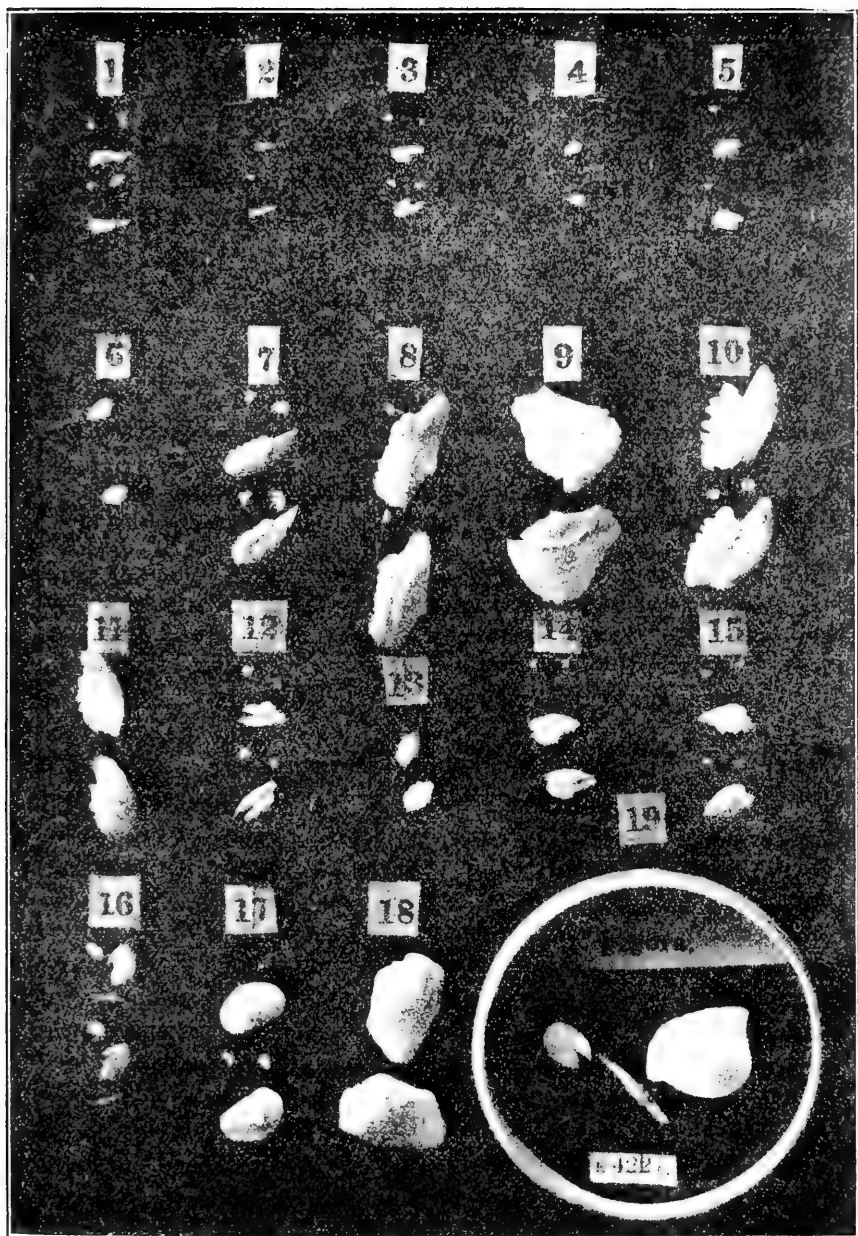


PLATE I.—Fig. 1. *Pelamys sarda*. 2. *Auxis rochei*. 3. *Brama raii*. 4. *Blennius gattorugine*. 5. *Gobius paganellus*. 6. *Exocetus pæcilopterus*. 7. *Caranx trachurus*. 8. *Morone labrax*. 9. *Beryx splendens*. 10. *Sebastes norvegicus*. 11. *Pagellus centrodontus*. 12. *Labrus maculatus*. 13. *Osmerus eperlanus*. 14. *Salmo salar*. 15. *Thymallus vulgaris*. 16. *Cyprinus carpio*. 17. *Otolithus maculatus*. 18. *Plagioscion surinamensis*. 19. *Arius jagora* (half-set).

but not so large as *Beryx splendens* (Plate I. fig. 9), or that of *Sebastes norvegicus* (Plate I. fig. 10). The two former frequent the estuaries of rivers and the coast, the two latter very deep waters, *Beryx splendens* having been taken at a depth of over four hundred fathoms. Again, in Plate II. we may compare the otoliths of *Synodontis schal* (fig. 3), and that of *Ælurichthys gronovii* (fig. 4), both fishes of the Siluroid family. The contrast in the size of the

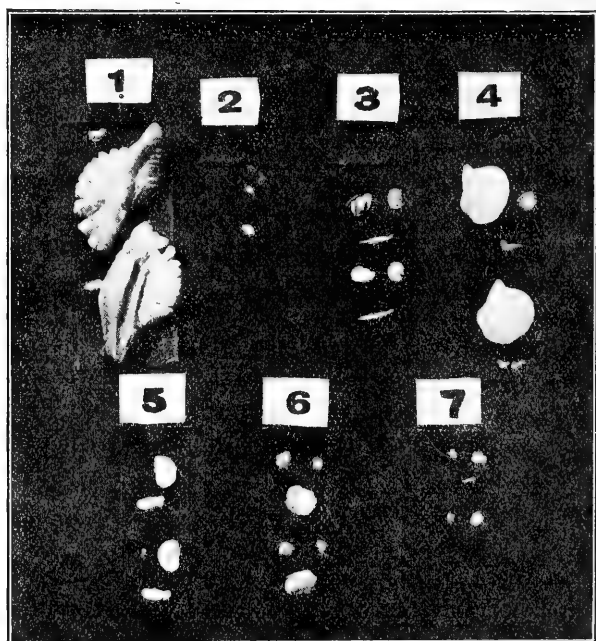


PLATE II. — Fig. 1. *Lopholatilus chamaeleonticeps*. 2. *Simenchelys parasiticus*. 3. *Synodontis schal*. 4. *Ælurichthys gronovii*. 5. *Polypterus senegalus*. 6. *Lepidosteus osseus*. 7. *Hydrocyon brevis*.

The above specimens were obtained by the courtesy of the Administration of the National Museum, Washington, U.S.A. (fig. 1); H.S.H. the Prince of Monaco (fig. 2); Mr. G. Boulenger, F.R.S. (figs. 3, 5, 7); Mr. W. Stuart Cameron, of Demerara (fig. 4).

lapillus is very marked, and does not need the statement of the weights, rather less than a quarter grain for the first against three grains for the second, to emphasize it. The first fish also had a much larger head, and was generally larger than the second. It lived in the Nile; the second fish came from the sea near Demerara, British Guiana. The above is a remarkable

contrast between a shallow fresh-water type and a deep sea-water type. It is interesting to note that *Ælurichthys gronovii* is closely allied to *Arius gadora*, whose otolith is shown on Plate I. fig. 19.

Beryx splendens lives in very deep waters, and *Myripristis murdjan*, another of the *Berycidæ*, lives in water near the shore, therefore much shallower, but it likewise has a large otolith. Here, then, they follow a family type irrespective of the depth at which they live. The more commonly known Flat-fishes (the *Pleuronectidæ*) all have comparatively large otoliths, and of other fishes that live on the bottom of the sea, the Weever (*Trachinus draco*), *Uranoscopus scaber*, and the Gobies, each have large otoliths. We have here several different kinds of fishes frequenting the bed of the sea, and each supplied with a fairly large otolith. For a comparison we must go to the Blenny family, many of which live on the bed of the sea, yet they all have small otoliths. Compare that from a *Blennius gattorugine*, Plate I. fig. 4, with one from a *Gobius paganellus*, fig. 5. These two fishes varied but little in size; their mode of life is fairly similar on the bed of the sea, yet the otolith of the Goby is manifestly the larger of the two. The Cod (*Gadus morrhua*), living and feeding near the bottom of the sea in deep water, has a large, solid otolith, and so has the Tile-fish, *Lopholatilus chamæleonticeps* (Plate II. fig. 1), which lives at the bottom of the Gulf Stream, hundreds of miles from the east coast of the United States of America. The *Scombridæ*, the Mackerel family, living in the surface strata of the deep sea where they find their prey, have small otoliths. Plate I., figs. 1 and 2, show otoliths of this family. The *Sparidæ* have, as a rule, large otoliths (one from a Sea-Bream, *Pagellus centrodontus*, Plate I., fig. 11, shows this); the otolith from a Ballan Wrass, *Labrus maculatus* (Plate I. fig. 12) is much smaller, and strikingly different in shape. The two fishes, however, frequent much the same localities and depths; both are littoral fishes.

Plate I., figs. 13, 14, 15, illustrates three different kinds of otoliths from the family *Salmonidæ*. The first of the three (fig. 13) is the otolith of a Smelt (*Osmerus eperlanus*), fig. 14 shows that of a Salmon (*Salmo salar*), and fig. 15 that of a Grayling (*Thymallus vulgaris*). Their modes of life are different; the Smelt

frequents salt waters, the Salmon spends its life alternately in salt and in fresh water, whilst the Grayling lives in fresh water only. Comparing the three, the fresh-water fish has the largest otolith, but they are all fairly large.

Except with *Arius gagora* (Plate I. fig. 19), where it is on the right, the big rounded stone, the *lapillus* is always on the left, the *asteriscus* on the right, and the *sagitta* in the middle under the other two. The upper set are always from the right half of the head, and the lower set from the left side. In some cases the smaller otoliths were not got, and consequently are not shown.

Except those on Plate I. (figs. 16 and 19), and those on Plate II. (figs. 3, 4, 5, and 7), all the figures shown are examples of fish that have the *sagitta* as the largest of the three otoliths, in any one half of the skull; the examples are all from Teleostean fishes, with the exception of figs. 5 and 6 on Plate II. The exceptions are (Plate I. fig. 16) taken from a Carp (*Cyprinus carpio*), an example of the class of fish where the *asteriscus* is the largest otolith,* the *sagitta* being represented by a rod-like stone; Plate I., fig. 19, representing the otoliths of an *Arius gagora*, only those from one side of the head are shown; a member of the large family of Siluroid fishes illustrates the case where the *lapillus* is the largest otolith—it is seen on the right in the plate; in these fishes also the *sagitta* takes on the rod-like form. Figs. 3 and 4 on Plate II., both from Siluroid fishes, shows the same. In the family of the *Characinidæ* we have another repetition; it is shown on Plate II. fig. 7. In the otoliths from *Polypterus senegalus* (Plate II. fig. 5) is shown the example of a fish which has the *asteriscus* as the largest otolith, but in which the *sagitta* is not rod-like. The same occurs with the otoliths of *Calamichthys calabaricus* and *Amia calva*. In *Lepidosteus osseus* (Plate II. fig. 6) the *sagitta* is the largest of the three otoliths. The above four fishes are all of an early type; they are of the Ganoid order. Three of them differ from the fourth in the manner noted.

On Plate I., figs. 17 and 18, are shown otoliths from two of the *Sciænidæ*; fig. 17 from *Otolithus maculatus*, a fish from the Indian Ocean; and fig. 18 from *Plagioscion surinamensis*, a fresh-water *Sciænoid* from British Guiana. Each shows the granular con-

* This peculiarity of the *asteriscus* and *lapillus* was described in the paper on "The 'Asteriscus' in Fishes," 'Zoologist' (*ante*, p. 57).

cretions peculiar to the *Sciænidae*. A typical example of the remarkable constancy in the same family of fishes of the characteristics of the otoliths.

Fresh-water fishes, as represented by the Perch and the Carp family, are all supplied with fairly large otoliths. The only deep fresh-water fish obtained was the *Lota vulgaris*, a fresh-water Gadoid fish; its otoliths, however, for its family, were moderate in size.

A relation has been sought by comparing the power of vision of a fish as deduced from the muscles attached to the eyeball with their power of hearing, as deduced from the size of the otolith resident in the organs of hearing. In many fishes the recti muscles of the eyeball are attached to the skull at the back of the eye, giving a short range of movement; this is seen in the *Gadidae*. In others, again, these muscles are long, and go well back from the eyeball, resting in a long, narrow case parallel to the basisphenoid, and divided from the brain-pan by a bony septum; this is seen in *Pagrus auratus*, *Pelamys sarda*, and many others. Observations were made on sixty-seven different species of fishes representing twenty-nine families, and by classifying them we get—

Size of Otoliths.	Large.	Small.	Moderate.
Those having a long flexible muscle ...	12	20	6
„ „ short, strong „ ...	15	4	3
„ „ moderately strong muscle to the eye.....	4	3	

The long recti muscles give a quickly mobile eye, and are seen in the *Scombridæ*, which have typically small otoliths. The short, strong muscles are seen in the *Gadidæ*, which have large otoliths. Amongst the sixty-seven fishes above alluded to, the number of those having long rectus muscles giving a mobile eye and that have a small otolith exceeds those having a large otolith by nearly two to one, but in those that have short, strong muscles the number having large otoliths exceeds that of those having small otoliths by nearly four to one. But that quickness of sight makes up for dullness of hearing, or that

more acute hearing follows because of the increased size of the otolith, remains to be proved. In a paper on "The Structure and Functions of the Ear of the Squeteague," written by Professor G. H. Parker, Ph.D., and published in the 'Bulletin of the Bureau of Fishes,' vol. xxviii. 1908, Washington, U.S.A., it seems conclusively proved that in this fish the *sagitta* is essential to the function of hearing. But, as said above, it remains to be proved that better hearing follows in the case of a larger otolith.

All the foregoing remarks have dealt with the Teleostean fishes only, *i.e.* those having a bony skeleton. The large number of Elasmobranchii have to be considered. They are fishes with a cartilaginous skeleton, and do not possess solid otoliths; the place of the stone is taken by "otoconie," or ear-dust. The otoconie, like the otolith, consists of crystals of carbonate of lime. These cartilaginous skeletoned fishes require to hear, as well as the bony framed ones. Why their ear-membranes should contain dust instead of solid concretions is a mystery, but the fact remains; and in this connection it should be noted that the Sturgeon (*Acipenser strurio*) has both otoconie and otoliths in its ear-membranes.

Only one specimen of otolith from a very deep-sea fish has up to now been obtained for comment in this paper, and is shown on Plate II. fig. 2. It is from the head of a *Simenchelys parasiticus* that was obtained from a depth of seven hundred and fifty-eight fathoms. The otolith, which is the left *sagitta*, is small for the size of the fish. The right *sagitta* was damaged; only a fragment of it is seen.

THE VOCAL AND INSTRUMENTAL MUSIC OF INSECTS.

BY A. H. SWINTON.

(Continued from vol. xiii. p. 153.)

THE snowy pinnacles, blue gentians, and baskets of poet's narcissus that young girls bring down from the mountains are the chief charms of Switzerland, but the last have faded when the grasshopper concert begins. Foremost among the violinists comes the largish, yellowish-brown *Arcyptera fuscus*, chequered red and orange, and having the marginal and central areas of its fore wings, or elytra, dilated and crossed with veins that resemble the cords of a piano. This grasshopper Goureaux found in the thickets at Cologne ; I met with it in the crawling state at Montreux early in August, 1892. It was playing its selections at Geneva on the 15th, and hopping about at Chamonix on the 28th, when I was admiring the massive of Mont Blanc. It was a warm day when I first heard the loud sound of its violin resounding among the wild roses on the Saleve, and, wearied with the ascent, it was pleasant to recline in the sylvan shade and listen to its refreshing "dree-dree!" in the long and wiry grass, mellowed by the echo into a croak indistinguishable from that of the frogs and Cicadas ; the females, whose wings do not cover their portly bodies, bustled about as well as they were able, and exposed their ear-cavities to drink in the cooling melody. The smaller *Stauroderus scalaris*, a brown grasshopper with black knees and black tips to its elytra, also known as *morio*, inhabits the mountains of Northern and Central Europe. The musical male has the discoidal and scapular areas of its fore wings dilated with cross veins, and its bold notes "tsin-tirra!" are quite startling in the deep silence of the pine-clad hills that look down on Montreux, Chillon, and the placid lake ; they make you think your watch-chain has snapped. It is the only grasshopper I know that thrives in confinement ; briskly moving its

crank-like legs from thirty-five to forty times, it would cause a bird-like warble to resound through my sleeping apartment at the Villa Flora, where my relatives were staying, that resembled the dirl of a circular saw, followed by scissor snippings; and it rang the changes night and day in defiant response to the noise of the carpenter's plane, the hammering of the blacksmith, and rumble of carriage wheels. It lived and merrily sang, making its life an infancy, from June 18th until July 28th; the females I met with on the mountains in September. *Stenobothrus lineatus* has elytra slashed with velvet green; the discoidal or central area in the male is glassy, with piano-string veins, and at its extremity there is a dash resembling white paint; the female has the fore edge white. It may be found on the Surrey chalk downs; I saw a male at Guildford on July 12th, 1881, and about that date they may be heard sounding out their long-sustained "tin-tin!" both at Guildford and at Reigate. On Aug. 6th, 1883, I discovered both sexes wandering among the escargots and deadly nightshade at White Hill, further on. I then noticed that when a male encountered a female it made a snapping noise. The *Omocestus viridulus*, which may be recognized by the brighter green splay on its plain brownish elytra, takes its delight in the grassy swamps of the New Forest, mottled over with glandular sundews and downy Saint John's wort, where, on June 18th, 1882, I listened to the males drawing the fiddle-bows of their hind legs to the tune of "vree-vree!" as it were the trickle of a rivulet. I have heard this music on the declivity of Newland's Corner, near Guildford, once the resort of picnickers, and in the swamp surrounding Odiham Castle, which, we are given to believe, in the days of Simon de Montfort, was the resort of Cranes, or as likely as not of Herons. In the West Highlands I have heard it on the small island of Little Cumbrae, and on the mainland of Kintyre, which an examination of the peat-bogs intimates was once covered with silver birch. In August, 1876, I chanced to be staying with Scotch relatives at Whitehouse, on West Loch, Tarbert, and I often wandered up the course of a brook where *Erebia aethiops* was fluttering about among the water-dropwort, foxgloves, and honeysuckle. Here I have sat down to listen to the green grasshoppers playing their strathspeys and jigs many a time to while away the idle

hours. The males came and performed for ten seconds and for twenty-five seconds, as young cocks were wont to crow on the dunghill, and when one waylaid a female on some sunny bank it would approach its head to her hind body, and make brisk music, which it varied with jerks of both hind legs, sounding out "tit-tit!" a harsh, grating, and emphatic note; or at other times it would go through a strange antic, kicking out its hind legs like a horse. When coupled it was mindful to reply to the overture of a comrade, and on alarm the male and female took a flying leap. Having an inferior violin, this musician cannot be compared to the previous ones.

Other grasshoppers populate the hillock parched by the summer sunshine. The "retetee!" of the red-shanked *Omocestus ventralis* resounds merrily in autumn among the furze all over Europe, and I have a specimen found in September in Cashmere, which only differs in the knees being less blackened. In Norway I have met with snuff-coloured varieties whose orange legs concealed them on the heather stained by the stagnant swamp, and on the Swiss mountains, and around Nantes and Turin I have met with the handsome black variety in which the hues of burnt sienna and Vandyck one is wont to admire in the Devonshire cows commingle. The red-legged grasshopper is a wandering minstrel; I have heard one play its "retetee!" like the mellifluous warble of a brook, for more than twenty seconds, and then, on unexpectedly encountering its rival, at once to throw out a challenge of "whee-whee!" after which it lowered its left leg to listen; and then, presently meeting with a female of a distinctly different species, it sounded "thiph-thiph!" So does the instrumentation of some sprightly opera with quips and cranks ring the changes from grave to gay to express unknown emotion. Grasshoppers are born musicians, and this one has an excellent violin, for the wing areas on which the hind legs strike are all dilated with cross-veins. The common *Stauroderus biguttulus* may at first sight be recognized by its soft and downy breast and fore legs, for it is hairy, like Esau, and what ladies would call a "cossetting creature." Found all over Europe in endless variety of subspecies, it is well named the "Variable Grasshopper"; its sports are brown, green, and ochreous. On sandy spots, such as the Calais flats and table-

land at Valladolid, a yellow-green variety is seen, and in its company there crawls a pale grey variety with a good deal of dot and dash on the elytra. The prettiest sport I found enjoying the sunshine of Valladolid; it had its legs and body coloured a warm orange-red, and seemed some import of the tropics—a flying nosegay, for the species has some power of flight. I saw an individual attempting to fly on the Calais flats, and on Sept. 20th, 1883, I noticed one taking a parachute leap on a hedgebank at Guildford. On the islands of Guernsey and Herm I have met with dwarfed males, and I have found pink specimens often at the seaside, but sometimes inland, as at Guildford in September, 1885, and on the Grande Saleve, at Geneva, in August, 1892. These have the same resemblance to the ordinary grasshopper that a boiled Lobster has to a live Lobster; I have noticed this change of colour in acorns. On the hills of Surrey the cheery “wree-wree!” “wheep-wheep!” and “reta-reta!” of the Variable Grasshopper resounds from the end of June until October brings the frost and damp. When the male begins its music it moves its legs forward swiftly, giving from eleven to twenty-one strokes over the glassy front edge of its elytra, and then for five seconds the notes run together with a liquid trill delightful to the imagination of the female, who sits sweltering on a sunny bank with a leg lowered to expose an ear-cavity, and interpret a language of flowers; sometimes, overpowered by the languid breath of summer, the enamoured male gives six laconic strokes, with a pause between each floating note, after which it depresses a leg, the right most readily, to listen and await a response; and should it then get none, it will leap forwards on to a grass-stalk, crawl down it backwards, clean its head and its antennæ with its fore legs, and strike up again. Should a dazed and sleepy rival come in its way it will leap on it, give it a bite, and so elicit an angry response. But it is when celebrating the requiem of summer that the music of the Variable Grasshopper becomes a sentiment. In October, 1876, I went to Calais on a visit to cousins, the daughters of Thomas Hog, the editor of ‘Trivet’s Chronicle,’ and a brother-in-law of Frazer Tytler, the historian. The year departed in smiles, while I daily perambulated the old ramparts, watched the children and dragonflies at sport in the gardens of the Frontsud, or walked on the jetty where the

painter Turner saw the packet-boats arrive. I recall that the only time I ever saw Thomas Hog, *paterfamilias*, a little spare man, he rapped his snuff-box, and astounded me by saying he had once taken an oar and rowed the packet-boat from Calshot to Southampton. In those days when becalmed mid Channel on a voyage to Boulogne, it was the fashion to fish for Mackerel. Often on my return, after seeing the prismatic beauty of a misty sunset, I heard, in gloom of the evening, a fitful moan of grasshoppers where the dark soil at the seaward foot of the glacis afforded them concealment, and instinctively understanding this to be their epithalamium, I returned in the glow of noonday to be present at their nuptials. As I drew near the scene of the tourney, I heard a surging sound that resembled the drag of the waves on some pebbly shore which when I approached arose like the sound of a hasty shower, and melted on the ear like the patter of aspens, the bubbling of water, and the remote warble of nightingales. Then sitting down on the seaweed to understand the ways of Liliput, I observed that it was the charms of a corpulent female, so much in estimation in eastern lands, that provoked the astounding chorus, for whenever she was espied by a wandering male, he jerked his right leg forward with a sound of "thirp-thirp!" and then the grasshopper bands around, one and all, vied in celebrating her praise, the favoured beauty the while retaining a leg lowered to revel in the adulation. When a rival appeared the male, who was executing a solo, flew in his face like an angry dog. On finding himself again alone he gave a gentle stroke with his legs, producing but little noise, and, leaping on the female, he gave her a quiet bite. This caused her to hop off, whereupon he followed, and endeavoured to engage her attention with a tune, until his patience being exhausted, he swayed a leg forwards from one to five times, producing a goose-like cackle, at which critical moment one of those black Rove Beetles, known as the "Devil's Coach Horse," came on the scene with open jaws and cocked-up tail. That autumn seems to have been favourable for the increase of grasshoppers, for when the stove was lit on Nov. 26th, and my lady friends were working monograms and solving conundrums, I took up the 'Univers' newspaper, and read a notice from the south of Spain, which told of an alarming invasion of the

country around Gibraltar, Jaen, and Xeres by Locusts, supposed to have come from Africa.

The terminal joints of the antennæ of a grasshopper are pitted like the carapace of a Crab or Lobster, or the leaves of thyme and rosemary, and these pores no doubt enable it to inhale the manifold fragrance of the herbage, and distinguish what is noxious and what is good for food. About seven of the European grasshoppers have these joints dilated into a flapper, recalling the knobs of a butterfly, and these take their delight on sunny hills. The male of the minute *Gomphocerus maculatus*, that has piano-string cross-veins on the central cell of its elytra, rattles away like a Canary on hill and dale in Surrey. I have watched it wandering among the tufted gentians and starry yellow-wort on the declivity of Box Hill, perambulating the heathery knolls of Norway where the cloudberry grow, and the desolate lands of Brittany; on the height above Pallien, near Treves, where there is a panorama of the valley of the Moselle, I found one that was snuff-coloured. The *Gomphocerus rufus*, which can be only distinguished from the Variable or Common Grasshopper, which its varieties exactly resemble, by the knobs on its antennæ, I have met with on Box Hill, near Turin, and at Montreux in September. One would imagine that it and the Variable Grasshopper had a common ancestor. When the male performs it vibrates its legs to and fro twenty-four times, and gives ten strokes before the "thiph-thiph!" that sounds for five seconds is heard. When soliciting a female it moves its legs to the tune of "wuf-wuf!" As the elytra have not the piano-strings invariably distinct, certain individuals must acquire celebrity for their music, and, finding more readily a partner, generation after generation will celebrate in louder and louder tunes the balmy air of Surrey. The male of *Gomphocerus sibiricus*, who has his fore tarsi clubbed in order to properly lay hold of a wary female, on the alpine slope sounds out "tray-tray!" You may hear it among the rhododendrons at Pontresina, on the Dent de Morcles, or Rocher de Naye.

Certain grasshoppers differ from the preceding in having their thorax less pinched in like those tight stays that the doctors consider so objectionable. The *Chorthippus parallelus*, small and wiry, with brownish or greenish translucent elytra,

and a sluggish semiapterous female, is at home on the Hampshire heaths, where it enlivens the bare, sunny patches among the scattered furze-bushes with its "thiph-thiph!" I have met with it in Spain in July, in Norway in August, and in Switzerland in September, where I sometimes heard its joyful music arise after the warm sun had gone down on the Lake of Geneva. Among the boleti-overgrown stumps and amber foliage of the birches on the moor of Rannoch, where the males, and especially the females, were blackened as with charcoal, I have heard its melody as late as Oct. 11th. The *Chorthippus albomarginatus* has a gayer greenish yellow appearance; the note of the male, "whir-hewee!" made by four strokes of the hind legs, is first heard among the meadow-grass at Morges, on the shore of the Lake of Geneva, in June, and when five seconds are gone he sounds out again, often lowering the right leg to listen. When soliciting the favours of his female he executes a harsh and imperative "creech-creech!" by a skilful movement of both legs, or one only. The *Chorthippus dorsatus*, larger, with puffed-out cheeks and sienna brown in colour, I have found at the outset of July living happily on the site of Whitlesea Moor, once the paradise of the entomologist (where a man driving cows gave two jumps to show how the water under the sod caused it to undulate), and later on at Ramsgate. In August I have met with it on the sandy soil of Leon, once the capital of Spain. Yersin says the male sounds out "raytzin!" The *Stenobothrus apterus*? or *S. brachypterus*?, mottled with sienna and gamboge, I have seen on the ascent above Montreux in September; like other alpine semiapterous insects, it is no doubt a variety of some species existing or extinct that passed its life in the valleys. A short and efficient musical comb runs along the lower end of the raised edge on the thigh of the male, and the somewhat feeble "ree-ree!" given out by the puffed-out, glassy elytra most approaches the shrill of the crickets, but the performer who is not absolutely sure of producing this admirable note sometimes contents himself with kicking up his hind legs. The males of *Stethophyma grossum*, slim, hop-brown grasshoppers with yellow and carmine stripes that populate the long grass at the side of swamps in Central and Northern Europe, are said to sound "tze-tze!" when molested by means of the raised edge on their

thighs, which is notched, but perhaps this is fancy. Mr. Kidd, a son of Dr. Kidd, of Godalming, once sent me two of the grasshoppers supposed to be British, which he had received from Mr. Barrett, who he made the acquaintance of when on a visit to Haslemere. I then wrote to Mr. Barrett, but his memory was at fault. Since I have heard from Mr. Bankes they may be found in the New Forest. I have seen them and the *Mecostethus alliaceus* on the banks of the Po; the latter, when they leap on to a reed, crawl backwards, as if they were going down a ladder. Once I saw a male trying or wishing to perform. It is supposed that the males of the genus *Pneumora*, with bodies inflated like a soap-bubble, that inhabit the Transvaal, make a terrible racket in the evening. I know little of South Africa, but I remember, when riding up the Lion Mountain at the Cape to see the silver trees, being tempted to dismount by some grasshoppers with coloured wings that I failed to catch.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Greater Horseshoe Bat in Wiltshire.—As far as I am aware the Greater Horseshoe Bat has not been recorded from Wiltshire, although it has occurred in the neighbouring counties of Gloucester, Somerset, Dorset, and Hampshire. It will therefore be of interest to record the fact that the Rev. J. H. Brown, of The Rectory, Great Cheverell, Devizes, sent me a fresh specimen of this Bat, taken in the glebe farm adjoining the Rectory, with a letter of June 29th, 1910. According to information supplied me by Mr. Brown there is at least a small colony there. Not wanting the specimen, I sent it to the Dublin Museum.—G. E. H. BARRETT-HAMILTON (Kilmanock House, Campile, Co. Wexford).

Black Variety of the Water-Shrew in Suffolk.—On July 10th I noticed a dead example of the black variety of the Water-Shrew (*Sorex remifer* of Bell) lying on the gravel-path close to the church-porch at Blaxhall, Suffolk. The nearest water is about half a mile distant. As this is by no means a common animal in the county perhaps the circumstance may be worth recording.—G. T. ROPE (Blaxhall, Suffolk).

Albino Variety of Common Shrew.—It may be interesting to record that I had given me (June 29th last) an albino variety of the Common Shrew (*S. araneus*). It appears to be a mature one. The belly is practically pure white, the rest of body and head pale cream. It was killed by haymakers at Dinton, about four miles from here.—EDWIN HOLLIS (The Museum, Aylesbury).

Albino Wood-Mouse in Montgomeryshire.—On Aug. 1st I received from Mr. Vincent P. Lort a young albino Wood-Mouse (*Mus sylvaticus*) which had been caught alive in a hay-field at Llanllugan, Montgomeryshire. So far as I can learn this is the first albino of the species met with in Wales, though there is a buff-coloured specimen (obtained in Cheshire) in the Chester Museum.—H. E. FORREST (Hillside, Bayston Hill, Shrewsbury).

A V E S.

The Nightingale (*Daulias luscini*) in Lancashire : a New Record.

—I am pleased to be able definitely to record the Nightingale for the county of Lancashire. Mr. W. Hardy, of Oldham, has just sent for my inspection a mounted specimen, together with many particulars relating to its origin. "About forty years ago" the bird took up its position in a small clough or wooded valley between Ashton-under-Lyne and Oldham, in the south-east corner of the county. So many people crowded to listen to it that the occupier of the land—a Mr. Webb, of Dean Shut—had the bird trapped, afterwards giving it to his neighbour, Mr. J. Hardy, the grandfather of my present correspondent. The history of the specimen appears to be quite beyond doubt. It is an adult with fresh plumage, showing no signs of captivity; nor have I been able to detect traces of either shot-holes or blood-marks on the feathers. This last supports the statement that the bird was trapped and not shot. Mr. Hardy cannot say which was the exact locality, but it must be one of two small cloughs tributary to the Medlock Valley between Parkbridge and Bardsley, on the Oldham side of the river. The southernmost of these is still very secluded, and not at all an unlikely place for the species, judging from its superficial resemblance to many Nightingale haunts that I have seen in other counties; and in 1870 the district would be far more suitable than it is to-day. I am pleased to say that Mr. Hardy is presenting the specimen to the Oldham Museum. It is not necessary here to discuss the many unsupported records relating to the Nightingale in Lancashire. Mr. Mitchell mentions the most likely in the introduction to his 'Birds of Lancashire,' but he does not include the species in his list. The latest account of the birds of the county ('Victoria History, Lancashire,' vol. i. p. 192) accepts the species, but the absence of any details of place, date, or observer detracts from the record. Mr. James Arlosh, in a brief footnote to a general paper (Trans. Cumberland Assoc. Lit. and Science, pt. v. (1879), p. 131), says that it visits each year Prestwich Clough, near Manchester, but he gives no authority for his statement. The Nightingale has occurred, and apparently nested, within ten miles of the present Lancashire locality—at Romiley, in the neighbouring county of Cheshire, and within fifteen miles at Strines, on the Cheshire-Derbyshire border (*cf.* T. A. Coward, 'Vertebrate Fauna, Cheshire,' i. p. 132); but, so far as I know, this Oldham bird is the only existing specimen from either Lancashire or Cheshire.—FREDK. J. STUBBS.

Red-backed Shrike (*Lanius collurio*) breeding in Merionethshire.

—On June 23rd I saw a male Red-backed Shrike (*Lanius collurio*) on the telegraph-wires by the railway near Arthog, Merionethshire. On examining him with the field-glasses I found he had a grasshopper in his bill. After a few minutes he was joined by the female bird, which was carrying a small beetle. From the wires they flew into an oak-tree, and there the male perched on the end of a dead bough, calling harshly, and vigorously jerking his tail. Immediately below was a thicket of seedling birches, varying in height from a few inches to ten feet. Presently he dropped into this, and shortly afterwards was



NEST AND YOUNG OF RED-BACKED SHRIKE.

followed by his mate. On entering the bushes I heard the nestlings, and after some searching came across the nest in a birch about nine feet high. It was placed about five feet from the ground, and was, as usual, large and not very neatly put together. Small twigs, bents, coarse meadow-grasses, and sheep's wool were the materials used for the outside, and the nest was lined with hair and cotton-grass. The latter grows in profusion on Arthog Bog, and I found the nests of several other species lined with it. There were four young birds apparently some ten days old, and one addled egg in the nest. The

nestlings were generally of a buffish colour, the head being paler than the body; the under parts were distinctly spotted and barred, and this became more noticeable before they left the nest. The tongue and the inside of the mouth were orange-yellow in colour and unspotted. The flanges were pale yellow, and the upper mandible was distinctly down-curved. There were no thorn-bushes near to the nest, and I was unable to find any insects impaled on a gorse-bush near by. The parent birds were very bold whenever the nest was approached, and when I put up the camera to photograph the young they moved from bough to bough, continually jerking their tails up and down, and "chacking" in a most threatening manner. The nestlings left the nest on June 29th. This Shrike used to breed in some numbers in the Barmouth district, but is certainly less common than was formerly the case.—C. KINGSLEY SIDDALL.

Lesser Redpoll at Hampstead.—Since the publication of my note on the breeding of the Lesser Redpoll here (*ante*, p. 269), I have found two more nests, making seven in all this year, and quite half a dozen more must have eluded my search. On one occasion I found a male bird sitting on one of the above nests, and while so occupied he commenced his loud trilling note, which soon had the effect of bringing up the female, who fed him on the nest, although I was standing within two feet of it at the time.—C. H. MEYRICK (The Mount, Hampstead).

Mortality among House-Martins.—It would be interesting to know in what other localities the House-Martin (*Chelidon urbica*) has decreased as in this neighbourhood. During the first week in July I picked up several dead ones in this and adjoining parishes, since when I have kept careful observation on the species, and find its remaining numbers are few indeed, while I fear the mortality has been a very heavy one. From several other places in this county I hear of the same scarcity. During June we had a prolonged spell of wet and cold weather, and this may have affected their food-supply. On the other hand, Swallows, Sand-Martins, and Swifts do not appear to have been similarly affected, and the former at least have succeeded in providing for full nests of young. That the House-Martin depends to an extent on a different food-supply may account for such results.—J. STEELE-ELLIOTT (Dowles Manor, Shropshire).

An Account of a Ramble with the Birds in Anglesey and Carnarvonshire.—Our rambles in the interest of bird-life this year commenced on the 24th day of March, on which date we cycled to

Anglesey, a hilly district, where last year a pair of Buzzards bred. We only saw one Buzzard, which was sailing high up above us, mewing at times, but it soon disappeared from our view behind one of the hills. Although the old eyrie had been repaired, the birds never used it, but they brought off another brood somewhere in the same district, as, during a period of three weeks of our visiting the place, we only saw one of the birds, and then we noticed the pair together again, from which we concluded that one had been engaged in incubating. On Good Friday, my friends had the good fortune of seeing six Buzzards together in the air, and they said that it was wonderful to see them sailing and swooping after one another. Also, whilst sitting down on the mountain side, partaking of lunch, they watched a pair of Choughs feeding, and by the aid of a monocular they could easily distinguish their red beaks and legs. A Raven's nest containing two eggs was found, and a pair of Peregrine Falcons were seen near to Llyn D., on Easter Monday. Going up the Ogwen River on April 9th, we saw some Dippers and a pair of Grey Wagtails, and amongst some climbing plant growing on a young silver birch was a Long-tailed Tits' nest with five eggs. On April 15th the first arrival of the Swallow was noticed here. Some Bullfinches, Chiffchaffs, two pairs of Grey Wagtails and a Kingfisher were amongst some of the birds seen on the 17th on the Cegin River. This latter bird bred in one of the banks of this river last year, but, during the winter the bank was washed away, so we did not come across their nesting-hole this season. There are two Heronries close by this town (Bangor), which are flourishing on account of their being well protected, and towards the end of March the nests at one of them had eggs in, while some contained young. Castle Rock in Red Wharfe Bay, Anglesey, is a home of the Stock-Dove, and here on April 24th many eggs were seen laid in the rabbit holes, and in some cases in crevices. Near to the Tubular Bridge which spans the Menai Straits young Peewits were seen in a field, and at the woods there were some Carrion-Crows and a Kestrel. Just by the bridge, hearing a peculiar noise, we tried to locate it, and found that it was uttered by Guillemots, which had flown on to a stone ledge at the top of the bridge at a great height above the water. Here I may mention that my friends at Conway found a nest of a Long-eared Owl with three young birds, as well as nests containing eggs of Carrion-Crows, Magpies, and Redshanks. Aber is visited on May 4th, and in a hole in a tree are found two fully-fledged young of the Tawny Owl, while the parent bird itself, which

had been seen flying from out of the hole, had perched on a tree close by, and it was not long before it was being mobbed by Carrion-Crows. Some Ring-Ouzels, Wheatears, and a Woodpecker were noticed, whilst just before returning a Redstart was seen. May 7th we cycled to Penmon, but on arriving it started to rain so we did not stay there very long. However, at the cliffs we saw a pair of Peregrine Falcons and also five Gannets, but these latter do not breed here. A colony of Kittiwakes breed here on Trwyn Dinmor, and on this day they were flying together a little out at sea. We again visited Penmon the following Saturday. As we neared our destination we perceived a Stonechat flitting about some gorse bushes, so we immediately dismounted and went in the direction of the spot. When walking through the long grass we flushed a Skylark from its nest containing three eggs. Soon the Stonechat was joined by its mate (the hen), and together they were very excited at our intrusion. After a long vain search for their nest, we came across a young one hiding beneath the gorse. Just as we were on the point of going for our bicycles, a bird alighted on the ground not far off which puzzled us at first, but on getting closer we found that it was a Yellow Wagtail. It was about six and a quarter inches in length, with a much shorter tail than the others of its species, this being dusky brown with the two outer feathers white; chin, throat, and breast yellow; back, olive brown; wing coverts, dusky brown; primaries and secondaries, dusky brown, the former being edged and tipped with yellow, and the latter only being edged with yellow. At length it flew off, and on following it we saw it in company with another bird like itself, though a little brighter, and this was probably its mate. Although the Yellow Wagtail has been recorded as seen passing over the west of Anglesey, I think that this is the only record of it having stayed in the county, for the pair were again seen there about a fortnight later. They might possibly have nested there, but although we searched carefully for the nest we were not able to discover it. Proceeding on we passed by an enclosed area where deer are kept, and on a pond within were a pair of Sheld-Duck.

At the Priory Woods Jackdaws were seen going in and out of their nesting-holes in the old trees. Now and then we heard the "yaffle, yaffle" of a Green Woodpecker, and although we came across many nesting-holes of this species, we found that they were nearly all occupied by Starlings. In a hole in one of the old trees we found a nest of the Tree-Sparrow containing five eggs, and another one

empty. When crossing the common towards the cliffs, we saw a Meadow-Pipit rising from the bracken and grass-covered ground ahead of us. On coming to the spot, we found the nest with its three eggs after a little trouble, built beneath the friendly shelter of a bracken leaf. The Kittiwakes had by to-day settled down, and some of them had nests nearly ready. As we were lying down full length on the top of the cliff, peering down, a bird flew from out of a crevice in the rock about two yards below us. This was a Rock-Pipit, and, after endeavouring to see into the nest, we found that it contained four greyish rather long eggs. A Kestrel was seen leaving a little cliff, but we could not discern any eggs on the grassy ledge whence it flew.

Before leaving Penmon we found a single Oystercatcher's egg, laid in a scratching lined with sheep-dung as a substitute for pebbles. One evening following this, we cycled to Llyn-Bodgylched. Here, just as we arrived at the top of a little hillock in view of the lake, the first birds that met our gaze were a pair of Coots, together with their brood of six. The old birds immediately flew off, their tails trailing the water in doing so, while the young scattered in all directions into the rush. Next we found a nest with five eggs of a Sedge-Warbler, which was very well hidden in the thick sedge. In walking through the reeds, &c., we came across a brood of young Wild Duck, but we did not get a long glimpse of them, as they soon disappeared, and all we could see was the shaking of the reeds where they were. A few Reed-Buntings were flying about, the cock birds of which were very conspicuous with their black heads. At the other end of the lake, a flock of Black-headed Gulls rose up from the rush and kept screaming overhead. Thinking that they might have nests, we waded out, but, alas! we could not go as far, so we could not ascertain whether or not they had nests, but the place is very suitable for them. On Whit-Monday my friend went to the mountain, I myself going to Newborough in order to see the Merlins which I knew bred there. Leaving my bicycle at a farmhouse I pushed forward into the sand-dunes, and found that Wheatears abounded in the place; but, although common, their nests were difficult to find. In a marshy field near to the sea I watched a pair of Redshanks that were flying noisily overhead, thinking that they might have a nest, but from the noise they made and considering the time of the season, I thought that most likely they had young. Saw a Cuckoo being chased about by a pair of Meadow-Pipits, and on a river were some few Sheld-Duck. At length I arrived at the spot where the Merlins

had their nest last year, but now I could see no sign of them. However, I had not gone far from it when I heard a loud "kek, kek, kek," and there, sure enough, was the Merlin leaving a dune a little ahead of me. This must have been the male bird on the look-out, for, when I reached the dune, the other bird flew off from close by, and, on rushing to the spot, I discovered the four beautiful red eggs laid in a scratching lined with coarse grass. Meanwhile, my friend, who had gone to the mountains, was spending the afternoon in trying to locate a Peregrine's eyrie, but although the birds would frequently fly on to a whitewashed ledge, he could not make out where their eyrie was situated, not even by the aid of binoculars. He also saw a Raven's nest containing five young, and a nest of a Ring-Ouzel with two eggs. This Raven's nest was the third that we knew of this season, and I am glad to say that each one of them reared off a brood—one of two, one of three, and this one of five. On June 7th I went with the Friars School Field Club to Puffin Island, where a most enjoyable time was obtained. Herring-Gulls, Lesser Black-backs, two pairs Greater Black-backs, Puffins, Guillemots, Razorbills, Shag, Oystercatchers, Rock-Pipits, and a Wheatear were the birds seen on the island, and some eggs and young of some of these species were found. After having been on the island for about two hours, news was brought that one of the boys had fallen over a cliff, and was seriously injured, so everybody was obliged to return quickly to the little steamer, and on our arrival at Bangor the unfortunate lad was taken to the infirmary, where he is now rapidly recovering. Knowing that the Nightjar occurred at the grounds near to the Tubular Bridge, we visited there on July 15th, and began beating about in the ferns. When we arrived at the other end of the field we at last flushed the Nightjar, which flew noiselessly away from its two eggs harmonizing so well with their surroundings. This was the fourth year that we knew of for the bird to breed at this place, and each time it had reared off a brood. Before leaving we found a Kestrel's scratching, situated in a hollow formed by the roots of an oak-tree, growing outward from the top of a cliff, and in this were laid four eggs. A few Corn-Buntings were seen perched on the telegraph-wires, uttering forth their long-drawn note, and a White-throat and a Tree-Pipit were flitting about a hedge. Aber was again cycled to, and in going up the river we saw some Dippers and Woodpeckers, the latter flying hurriedly away from the trees, calling forth their note. In a hole in a tree was found a nest containing five young of a Redstart, and near by a nest with three eggs of a Spotted Fly-

catcher. At a lake (the name of which is not known to me) in Anglesey we accidentally came across a pair of Mute Swans with four cygnets, and these could not possibly have been placed here, as the district is very wild, and all the birds kept away from us. The last two places visited were Llanferfechan and Bwrdd Arthur, in Anglesey, by my friend alone, I myself being unable to accompany him. At the former place he found eggs of Lesser Terns and Ringed Plover, and at the latter place were a colony of Cormorants breeding. Before concluding, I must mention that my constant companion referred to is H. King, B.Sc., of Bangor.—T. OWEN (Pen Parc, Bangor, North Wales).

Notes on Nest-boxes.—During the past season we have had in our nest-boxes, &c., the Robin (three nests in kettles), Great Tit, Blue Tit (several nests of both), Creeper (behind a piece of wood nailed to a birch), Tree-Sparrow (many), House-Sparrow, Starling, Tawny Owl, Stock-Dove. For the first time for many years we have had no Nuthatches, nor did any come to feed in the winter. One box contained nine Tree-Sparrow's eggs at the same time, but when blown they proved to be a mixed lot, some being quite fresh, and some stale. The Tawny Owls, which have bred in the church-tower for the fourth year in succession, had four eggs, and took away two young birds; but another pair, which nested in an old cask in our grounds, reared four young from their four eggs. The hen in the cask, a very fine reddish-brown bird, was very tame, and never once left the nest or even moved when I put a ladder up. When the owlets were about a week or ten days old, she would lie half on her side at the far end of the cask with her family a few inches from her, looking rather like an old Cat with her kittens, and the whole group made one of the prettiest pictures of bird life I have ever seen. The best bag I have seen in either nest was one of four Rats in the one in the tower. Stock-Doves have not done well; more than one clutch of eggs was destroyed, and a pair of young ones about the size of Blackbirds were killed in the box. This I believe to have been the work of Starlings. A pair of Blue Tits used an old House-Martin's nest on a neighbour's house, where there has been a Martin colony for years. They hatched out their brood, and seemed to be on the best of terms with the Martins around them. Some men hoeing wheat in the adjoining parish of Norton showed me a Snipe's nest in the middle of the field; probably the wet state of the meadows had driven the birds to a higher and drier site.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

PERSONALIA.

Lieutenant Boyd Alexander.—We have at last heard definite news of the way in which Lieutenant Boyd Alexander met his death. The communication, which has come from Lieutenant Childers Thompson, can only increase our sorrow at the general loss to our country, and our sympathy with Lieutenant Boyd Alexander's family. There must be many who will be glad to know that a memorial to the brothers Boyd and Claud Alexander, both of whom lost their lives while engaged in exploration in Central Africa, will be erected in their ancient parish church at Cranbrook, in Kent. Amongst the subscribers to the fund are the Royal Geographical Society, the Rifle Brigade, and the Scots Guards. As Boyd Alexander was a contributor to 'The Zoologist,' some of your readers may be glad of an opportunity of making a contribution to the Fund. Subscriptions may be paid to the Alexander Memorial Fund, London County and Westminster Bank, Cranbrook, Kent, or to myself.—WM. BELL (Cranbrook Vicarage, Kent).

THE 'Bulletin of the Société Géographique de Paris' publishes the following comments on the murder of Lieutenant Boyd Alexander:—

"On April 2nd last the English explorer, Boyd Alexander, well known for his important expeditions to Africa, was assassinated at Nieri, about seventy miles to the north of Abeshir. No responsibility devolves upon the French authorities for this tragic accident; not only did they warn Lieutenant Boyd Alexander of the dangers he was running in trying to continue his journey towards the East, but also formally begged him not to leave our stations. Being persuaded of the futility of these fears, the English traveller set out, so to speak, surreptitiously. Some hours afterwards he was attacked and killed. The unfortunate explorer was the victim of the disturbed state of things created on our territory by natives under British jurisdiction. Darfur, which belongs to England, is the last stronghold of the slave-raiders; accordingly, finding their shameful traffic menaced by the occupation of Wadai, which henceforth shuts off their access to vast territories of our colonial empire, whence they used to come to draw their supplies of human cattle, the men of Darfur did not hesitate to proceed to attack our troops, and to raise the people of Dar Guimer and Dar Tama against us. Documents seized at Abeshir leave no doubt as to their having practised such intervention.

"This disturbed state of things is a consequence of the French and English possessions in that part of Africa not being delimited. In the interests of general pacification, not less than those of geography, let us hope that the delimitation will shortly be proceeded with. The frontier indicated in the text of the Anglo-French Convention of 1899 passes through unknown territories; moreover, the exact determination of the boundary will afford precious materials for a knowledge of a very interesting portion of Africa."—*African World*, August 6th, 1910.

NOTICES OF NEW BOOKS.

Birds of New York. Part I. "Introductory Chapters: Water Birds and Game Birds." By ELON HOWARD EATON. New York State Education Department, Albany.

IN 1844 the above department published a "comprehensive and finely illustrated treatise" on the Birds of the State, prepared by James E. De Kay, and now, after an interval of more than sixty years, the present massive first instalment of a much more exhaustive work is the subject of this notice. During the interval between the two publications no fewer than one hundred species of birds have been added to the State list, and the hope is expressed that a principal function of the book will be to further promote the protection of the birds themselves.

The introductory chapters are characteristic of the thorough and complete manner in which details are worked out by our American colleagues. The "Life zones of New York State," so far as the avifauna is concerned, are exhaustively treated and liberally illustrated. As regards the ever-increasing literature on birds, the following remarks are very applicable:—"The author has been asked many times to name the best book for the bird-student. This task is too difficult, for the requirements of bird-students are as varied as the number of books. The book is not of so much importance as the attitude of the student. The author learned more from an old thumb-worn, imperfect copy of 'Ornithology,' evidently compiled from the works of early writers, principally Wilson, than he has from any exhaustive

treatises of recent publication. He knew the coloured plates of De Kay's 'Birds of New York' so well that the species therein depicted were recognized at the first meeting in the field." To a large extent this is the experience of most of us, but even then it would scarcely be possible to find in an old publication the data on bird migration which are given in the present work, while the "county schedules" form a digest worthy of the admiration of a statistician.

As stated on the title-page, only the Water Birds and Game Birds find a place in this first instalment of the series, and besides the numerous illustrations in the text there are no fewer than forty-two coloured plates at the end of the volume. These deserve special mention, as the artist, Mr. Louis Agassiz Fuertes, contributes a foreword, "Illustrator's Note," an innovation that might well be more generally followed, for as a rule we only see the work of the artist, and know nothing of his opportunities or limitations; his personality is too much behind the curtain. Mr. Fuertes tells us that for accuracy the colours of birds, not alone their feathers, must be taken from "actual specimens, painted, in short, from living or fresh taken birds, before the settling of the body fluids or the disintegration or absorption of pigment could take place," while the high colour is only attained in adult birds and at the approach of the breeding season. For the last ten years the compilation of these colour records has been the most important part of the field-work of this conscientious zoological iconographer.

Not only may this quarto volume be a source of legitimate satisfaction to the author and artist, but also to Dr. J. M. Clarke, the Director of the Science Division of the New York State Education Department, to whose insistence this expensive work has been adopted as a State liability.

EDITORIAL GLEANINGS.

PROF. W. F. BARRETT, F.R.S., in an article on "Creative Thought" ('The Quest,' vol. i. p. 616), has approached the philosophy of the biological arena from the somewhat mystical standpoint. He writes:—"May not a similar cause be at work in the many cases of protective mimicry, as well as protective coloration, found in the animal kingdom? If we accept the usual biological explanation of protective mimicry, the long intermediate stages required by natural selection would render the creature not less but *more* conspicuous among its kind, and therefore expose it to greater danger of capture and less chance of survival. In fact I am convinced that biologists have too long closed their eyes to the *psychic factor in evolution*—the directive power of the unconscious within the organism. Evolutionary processes in nature are according to this view the expression of the creative power of thought, using the term in the wider sense already defined. But it is *thought immanent, operative and transcendent, within the organism*. And it is interesting here to recall the fact that one hundred and fifty years ago, Swedenborg—who was a true seer as well as a learned man of science—explicitly urged this very hypothesis of an inherent directive force in the development of the forms of life.* A century later E. von Hartmann, in his well-known work the *Philosophy of the Unconscious*, developed much the same view, only he rejects all anthropomorphic ideas, or any form of consciousness or personality in the Supreme apart from nature, whereas Swedenborg's theology is the reverse of this. Von Hartmann with

* "Thus in his *Economy of the Animal Kingdom*, § 275, he writes:—"We must acknowledge, if we think of causes and origins, that such a directive or formative force is not without but within the chick or embryo; and that it must exist within that substance that was first in the ovum, and that has life or soul within it," &c. In fine he tells us 'the infinite is in the finite, as in receptacles.' Moreover, now that telepathy may be regarded as a *vera causa*, every living cell in the organism (as Mr. Gerald Balfour has conceived) is possibly in telepathic *rapport* with every other cell, and our unitary consciousness may be the result of this *rapport* among the brain cells. The wide philosophical implications of telepathy have not yet been adequately discussed."

great wealth of learning shows that in the phenomena of instinct and of clairvoyance (which latter he states as did Schopenhaur, only the ignorant reject) we have additional evidence of the operation of the Unconscious in life."

"Is it therefore illegitimate to assume that the Unconscious, the psychic factor in evolution, is operative in the process of development to bring about more perfect organs and higher types of life? It seems to me impossible to explain, *e.g.*, the development of the mammalian eye according to the usual method adopted by biologists. It would take me too far aside from my present purpose to trace out this argument; I can only state after a prolonged study of the subject of vision, that blind and fortuitous evolutionary forces, or endless ages of natural selection, appear a more incredible hypothesis than the assumption of unconscious thought, ever operative within the organism, as the directive force in evolution."*

* "The bifocal eye of the Brazilian fish *Anableps* is inexplicable upon a purely naturalistic theory. Mr. T. W. Rolleston, in his suggestive work *Parallel Paths*, has referred to the *Anableps*' eye, pp. 100 ff., and shows how impossible it is for natural selection, laying hold of fortuitous variations, to explain this remarkable organ."

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M.A., LL.D., F.R.S.E.,

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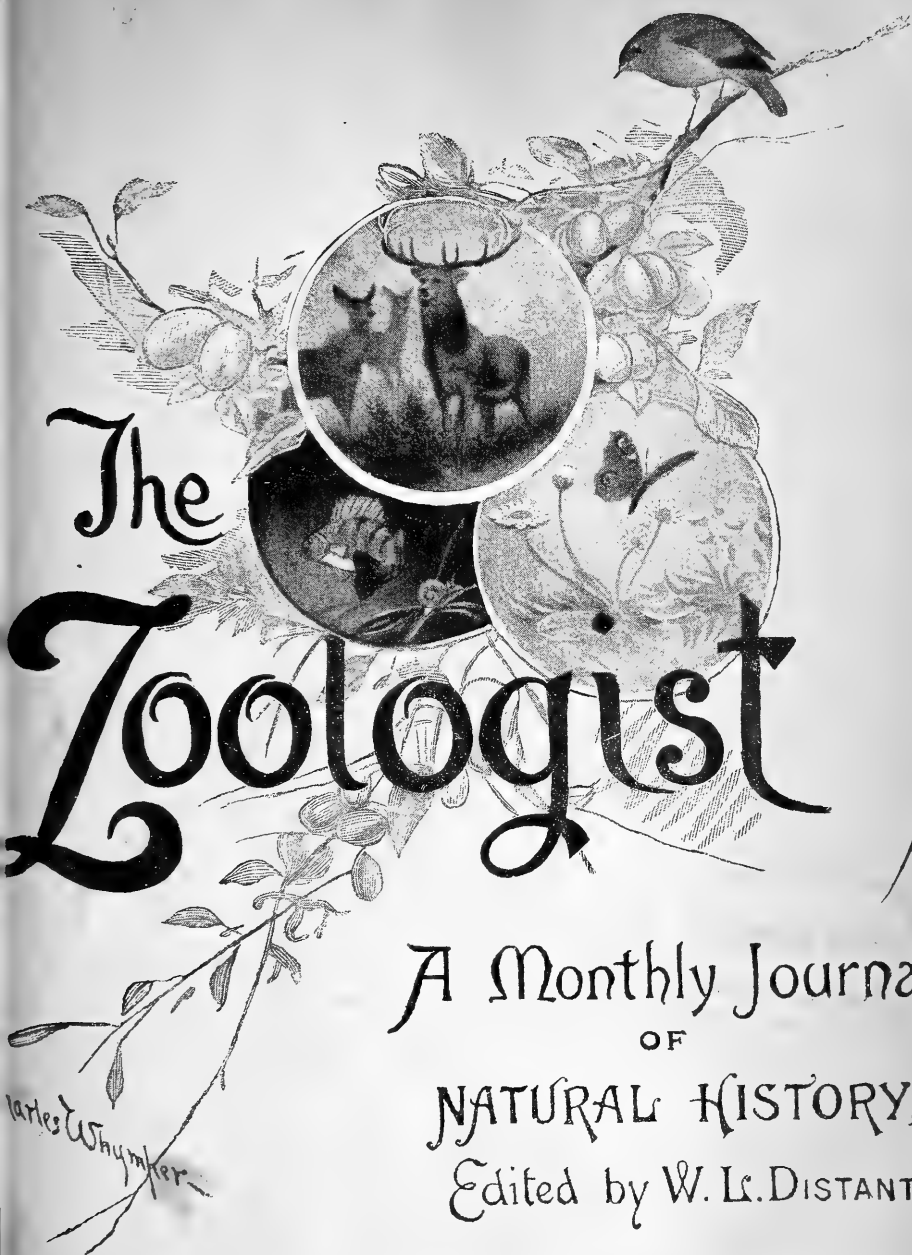
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THE ZOOLOGIST

No. 831.—*September, 1910.*

NOTES FROM THE MILLPORT MARINE BIOLOGICAL STATION.

By RICHARD ELMHIRST, Superintendent.

ON THE YAWNING OF FISHES.

WHILE watching the fish living in our Aquarium, I have repeatedly observed them yawning, or at any rate perform an action like yawning, consisting of a wide opening of the mouth, slow expansion of the buccal cavity, erection of the gill-arches, followed by a rapid expulsion of the indrawn water, most of which is emitted from the mouth, although some certainly goes through the gill-slits. This is often accompanied by a distinct heaving of the pectoral region and erection of the pectoral fins, and is quite different from the rapid movement of the operculum and jaws which is used to remove a foreign object, such as a bit of seaweed, from the gills. At first one would think that yawning is only possible for an air-breathing vertebrate with lungs. However, from numerous observations, I am led to think that this action of fishes is a real yawn, and serves the true physiological purpose of a yawn, *i. e.* flushing the brain with blood during periods of sluggishness. The conditions conducive to yawning are a slight increase in the temperature of the water and, I suppose, the accompanying diminution of oxygen. For instance, on Saturday morning we flush a lot of water through our tanks, and at midday leave the storage tank full. Now, we usually use a tankful in twenty-four hours, but to avoid pumping on Sunday we make the tankful last from

Saturday midday to Monday morning. Now, as this tank full of water is exposed to the sun on Saturday afternoon and all Sunday, its temperature rises in summer to 6° or 8° F. above that of the sea, and it is then that I have most often noticed the fishes yawning. I find also that when any individual fish is yawning frequently that the rate of its respiratory action is slower than usual. By respiratory action I mean the intaking of water at the mouth, and its emission through the gill-slits. For instance, I find the average rate for a certain Plaice is thirty-two per minute, and twice when yawning frequently it was as low as twenty per minute. A Dab has an average of about forty-two, and when yawning it was thirty-one. Sometimes, however, a fish yawns when the number of respiratory actions per minute is above the average. Cod seem to average about thirty-six per minute, whether yawning or not; I think they yawn much oftener than any others.

Whether the psychological infectiousness of yawning holds good among fishes I cannot say. I have certainly seen several yawn frequently, oftener than I have seen one give a single yawn. But this may be explained by the conditions conducive to yawning affecting several of the fish. This action is so suggestive that on seeing it I often start yawning myself. I find that a dog yawning before one induces yawning, although I cannot say that I have ever induced my dog or the fishes to yawn by yawning at them. I suppose human beings are probably more susceptible to such influences than the lower vertebrates. When several of a number of fish are yawning frequently, if one does anything to attract their attention all yawning ceases, *e. g.* if one performs actions as though going to feed them, they become excited, as when feeding is going to take place, swimming rapidly, following one, and making snapping movements as though seizing food. (From this it is quite clear that fish display an intelligent interest in what goes on outside the tank.) This sudden activity is accompanied by an increased rate of the respiratory action, which I suppose sets up a stronger circulation of the blood, and in this way relieves the sluggishness and its accompanied yawning.

The following list of the occurrence of yawning among vertebrates may be of interest. In the tanks at Millport the

Cobbler (*Cottus scorpius*), Saithe (*Gadus virens*), Lythe (*G. pollachius*), Cod (*G. callarius*), Ballan Wrasse (*Labrus bergylta*), Goldsinny (*Ctenolabrus rupestris*), Plaice (*Pleuronectes platessa*), Dab (*P. limanda*), Conger Eel (*C. niger*), and Skate (*Raia clavata*) have all been seen yawning by Mr. A. Gray (late Curator), Mr. J. Peden (Laboratory Attendant), various visitors, or myself.

Mr. G. A. Dunlop has observed the same action in Carp (*Cyprinus carpio*), Roach (*Leuciscus rutilus*), and Rudd (*L. erythrophthalmus*) in aquaria at Warrington Museum. Professor J. Graham Kerr has noticed a similar action in *Lepidosiren*.

Among reptiles and amphibians I have no written records, but have a vivid impression of seeing a Lizard and Newts yawn; I think the Common Frog and Grass Snake also. I seem, too, to have seen a photograph of a yawning Crocodile.

Mr. Gray keeps a tame Kittiwake which often yawns in the morning, just as fowls when first let out often yawn, stretch, and flap their wings. Mr. C. Kirk tells me Owls yawn, and he has published an excellent photograph of a young Carrion-Crow (*Corvus corone*) yawning in 'Gowans's Nature Books,' No. 19, p. 23. While working here in August, Mr. Dunlop saw a Lesser Black-backed Gull yawn.

Dogs, Cats, and their relations in zoological gardens often yawn. I am told that Horses, Cattle, and Goats yawn, although I personally never remember seeing them do so; I cannot find any records of a rodent yawning.

LITTORAL FEEDING HABITS OF SOME LAND-BIRDS.

During last autumn I frequently noticed Starlings feeding between tide-marks, and later, during severe wintry weather, Robins, Blackbirds, and Thrushes as well. The Starlings were generally in small flocks of six or more. During the spells of dry weather this year (*e. g.* June 1st to 18th, rainfall .06 in.) numbers of Starling families fed regularly between tide-marks. On June 10th and subsequent days I watched the young ones being fed. The adults are expert shore-collectors, and catch *Gammarus*, *Idotea*, *Ligia*, *Littorina*, &c., for the young birds, who sit about the stones, and in turn follow the old bird to be fed; the favoured individual displaying considerable excitement. Young Jackdaws also frequent the shore, but they go about tips and

scavenge rather than collect animals. Old Blackbirds fed on the shore, and also took food away with them.

It will be interesting to find out if land-birds ever become infected with helminth or other parasites through feeding on the shore. Miss M. V. Lebour has lately examined four Starlings for trematodes with no result. I find the *Acanthocephalan*, *Echinorhynchus cylindraceus*, Schrank, is common in the Starling, and also occurs in the Blackbird. I have observed stomach contents as follows :—

Starling	I. Nov. 1909.	<i>Gammarus</i> , also beetle remains, and tip refuse.
„	II. „ „	<i>Lacuna divaricata</i> , <i>Gammarus</i> .
„	III. June, 1910.	Four <i>Gammarus marinus</i> .
„	IV. „ „	Six <i>Littorina obtusata</i> , two <i>L. rudis</i> , <i>G. marinus</i> , <i>G. locusta</i> ; also a Thysanuran and a Lepidopteran larva.
„	V. „ „	Over fifty <i>Gammarus</i> , five beetles.
„	VI. Aug. 1910.	Ten <i>L. rudis</i> , over fifty <i>Gammarus</i> , insect remains.
„	VII. „ „	One <i>Rissoa cingillus</i> , twenty <i>Gammarus</i> , and beetle remains.
„	VIII. „ „	Six <i>Gammarus</i> , pips and bits of apple-skin.
Blackbird, Nov. 1909.		<i>Lacuna divaricata</i> .

This list shows that they feed much as the shore-birds do. Last November a Purple Sandpiper contained sponge spicules and some *Gammarus*, and a Redshank contained *Idotea*, *L. obtusata*, and *L. rudis*. Among the weeds near high-water mark, where the Starlings feed so abundantly on *Gammarus*, the Turbellarian (*Gunda ulvæ*) is very common, yet they do not appear to touch them.

VARIATIONS IN THE DENTITION OF *ERINACEUS EUROPEUS*.

BY EDWIN HOLLIS, F.Z.S.

My attention having been attracted to some curious variations in the teeth of some Hedgehogs taken in the neighbourhood of Exeter, I consulted several books, and found that they all give as a characteristic the fact that *E. europæus* differs from the other members of the *Erinaceidæ* in having the third upper incisors and canines single rooted, whereas in other species these have two distinct roots.

The following extracts (from 'Mammals Living and Extinct,' Flower and Lydekker) bring out the above distinctions very clearly. In writing of the *Erinaceidæ* they say:—

“The canine is very similar to the third incisor, and except in *E. europæus* each of these teeth is inserted by two distinct roots.”

“*E. europæus* is the most aberrant species, differing from all the rest in the peculiarly shaped and single rooted third upper incisor and canine.”

“The Indian form, *E. collaris*, may be considered characteristic of all the other species, the only important differences being found in the variable size and position of the second upper pre-molar, which is very small, external and deciduous in *E. micropus* and *pictus*.”

To emphasize the above points, they figure *E. collaris* (p. 620, fig. 280) and *E. europæus* (p. 620, fig. 285), both after “Dobson, Proc. Zool. Soc. Lond. 1881.”

The specimens I had under observation appeared to show characters placing them midway between *E. europæus* and the other species as above described. Thinking that this might indicate that these were of a distinct local race peculiar to Devonshire, I obtained further specimens from Sussex, Northampton, and Bucks, but found on examination that these presented the same peculiarities.

I give below a table showing the peculiarities of eleven skulls which I have now before me:—

	3rd Incisors.	Canines.	2nd Premolars.	
			Right.	Left.
1. Exeter	Single rooted	Double rooted	Rudimentary	Rudimentary
2. do.	do.	do.	Absent	Absent
3. do.	do.	do.	Normal	Normal
4. Aylesbury	do.	do.	Absent	do.
5. do.	do.	{ Single rooted, but showing signs of fu- sion of the two roots }	Normal	do.
6. Wellingborough	do.		do.	do.
7. Horsham.....	do.		do.	do.
8. do.	do.	do.	do.	do.
9. do.	do.	Double rooted	do.	do.
10. do.	do.	do.	Absent	Absent
11. Wellingborough	do.	Single rooted	Normal	Normal

It will be seen from the above table that only one specimen (No. 11) conforms to the type as described. I have since, by the courtesy of Mr. Oldfield Thomas, been allowed to inspect a considerable number of skulls in the collection of the British Museum (Natural History). I then found that a large proportion, probably half, of the skulls had double rooted canines, one having a single root on one side and double on the other, also that several show variations in the size of the second upper premolar. This tooth was in some cases extremely small and crowded for space, but, so far as I observed, in no case entirely absent, as in my specimens, Nos. 2 and 10.

Bearing in mind the third paragraph quoted above, I think this variation of the second premolar, which can be traced through all stages, from normal size to absence, is very interesting, and probably points to *E. europæus* being in a state of transition to a condition similar to that mentioned as occurring in *E. micropus* and *pictus*.

From the above observations it is evident that the teeth of *E. europæus* are extremely variable, and that the fact of the incisors being single or double rooted will no longer hold good as distinguishing this species from all others.

It will be interesting to see whether the study of a larger series of skulls will show any specimens with double rooted third incisors; if it does not do so, this may perhaps still be taken as a distinguishing character, provided that the study of a large series of skulls belonging to other species shows that in them the third incisor is invariably double rooted.

HUMBLE-BEES AND FOXGLOVES.

BY EDMUND SELOUS.

NOT being an expert in the Hymenoptera, and having been quite possibly (or even probably) mistaken in the correct scientific names of some of the bees whose actions are here recorded, I should like at the outset to point out that the interest of the observations contained in the following notes lies, not in knowing what bees do certain things, but what things certain bees do. It is, of course, a very good thing to be sure of the species that one is observing. One should always be so, if one can. Sometimes, however, one cannot, but that does not take away all value from what one has seen, except in some special cases where the identity of the species is all-important. Otherwise, an anonymous fact in natural history is not less interesting, on that account, than, in the domain of literature, an anonymous novel, for instance, may be.

Whilst staying at Frendenstadt, in the Black Forest, during the summer of 1907, I watched Humble-Bees visiting foxgloves, over a certain limited area where these grew thickly, to the exclusion of other flowers. The two species most frequently seen here were *Bombus hypnorum*, and another large Humble-Bee with a dusky, yellowish patch on the thorax, and a somewhat long and curved abdomen, the specific identity of which I have not been able to ascertain. The latter was much the commoner of the two, and I have nothing further to record of it than that it invariably, according to my observation, rifles the foxglove in the ordinary manner, by which I mean that, in order to do so, it first enters the mouth of the elongated sack or "glove" formed by the conjoined petals. *B. hypnorum* also usually enters the flowers, but individuals are to be seen which go, apparently by preference, to the exposed green calyces from which the blossom has dropped.

B. terrestris is less common there than with us. The first individual I particularly noticed was visiting the exposed calyces,

and before I had made any further study of its habits, my attention was drawn to a quite small Black Bee (*B. mastrucatus*, according to the nomenclature of the zoological department of the museum at Stuttgart), which interested me by invariably going to the neck or tube of the corolla, on the outside, and piercing it (*as it seemed*) with its proboscis. Whether it really did so, however, or only took advantage of a hole that had already been made there, it was difficult to be certain of. In many cases the latter plan was certainly adopted, but then it naturally would have been, if the flower had been previously visited and pierced by another bee.

The movements of this small bee were very quick, nor did it stay long at any one spike of the foxglove, but soon darted away from it to another, usually at some distance off. Moreover, during the time that I was able to watch it at any one, it was extremely difficult, if not impossible, to see the first actual entry of the proboscis into the tube of the flower, or to make sure, between the time of this happening and that of the bee settling, that the tube had not been previously perforated. On one point I soon satisfied myself, *viz.* that the bee did not first bite a hole, and then insert its proboscis into it, which, armed as it is with mandibles, and accustomed to use them, it might have been expected to do.

Continuing my observations, I soon found that it was not only the small Black Bee I have mentioned (*B. mastrucatus*) that obtains the nectar or juice of the foxglove in this way, but also *B. terrestris*, which I had before seen visiting the naked ovaries, to the neglect of those still enclosed by the blossom. I watched various individuals thus acting during the greater part of an afternoon, and noticed that it was not every flower on which they settled that they were able to perforate. In many instances they would feel about with their proboscis, as though seeking an aperture, and, failing to find it, fly to another one. When I picked these flowers and examined them, I found that they were intact, but the same bee, upon finding a hole in another, would at once pass her proboscis through it. As, therefore, the bees do not use their mandibles, and must know that they cannot of themselves pierce the tube of the corolla in any other way, it seems evident that they consciously search for

such of these as have been pierced, passing the others by. They never, in any case, enter the corolla in the orthodox manner, after finding that it is not perforated—that is to say, I have never seen one do so. The same remarks apply to *B. mast-rucatus*.

Besides the above species of Humble-Bee there is another, not very common, which I have not been able to identify. It is brown, like *B. hypnorum*, but not more than half the size even of the smaller forms of this, between which and the larger there is a considerable difference. It is also less furry than *B. hypnorum*, or than Humble-Bees generally, such fur as it has being mostly on the thorax. This small bee seems never to enter the foxglove, but settles, instead, as both *B. hypnorum* and *B. terrestris* sometimes do, on the naked capsules, after the blossoms have fallen, over the surface of which it passes its proboscis. For some time I thought that the habits of this bee were invariable, since I never saw it either enter the cup of a foxglove, or descend upon any part of the corolla, which it simply passed by. One day, however, I found what appeared to me to be an individual of this species inside a foxglove, in a drowsy or lethargic condition, such as often overtakes Humble-Bees. On taking it, out it fell to the ground, but, recovering, shortly, flew off, and went directly to another blossom, on which it alighted, and crawling to the base of the tube, outside, probed it through a hole which I have now no doubt that it found there. For some time after this I followed its movements, and saw that it now always went to the naked ovaries, instead of either entering or probing the cups, nor did it again alight on one of these. From this, coupled with its appearance, I believe it to have been the same small brown species that I had always before seen acting in this manner, and never getting into the foxgloves. Why, then, was it in one now? But for this apparent recovery one might suppose that it had crawled there to die, and it would be interesting to know how long afterward it really lived. Many bees, at this time, seemed, in appearance, near to death, whilst others had died actually, as the natural termination, apparently, of the same lethargic state. Bees, however, can have no idea of death, a matter not within the grasp of their intelligence, so that it would not be that, but the state of health

preceding it, which caused this bee to enter a foxglove against its usual habits, if there was really a connection between the two facts.

I made a similar observation in regard to *B. terrestris*, a species which, whatever are its habits in England, may be watched here, hour after hour and day after day, without ever being seen to enter the cup of a foxglove—always either the perforated necks of the flower or the naked green calyces are resorted to. This particular individual, however, when first observed by me, was just crawling, in a state, as it seemed, of great decrepitude, into one of the “gloves.” With the view of, as far as possible, testing its object in doing so, I took out my scissors, and snipped off a portion of the tube, longitudinally. Almost immediately I saw the proboscis of the bee shoot out, to an astonishing length, over the moist surface of the calyx thus laid bare. This was a wonderful thing to look at through the Coddington lens, which I could do now with perfect ease. The proboscis was very long, and when it seemed that it could stretch no farther, another and thinner portion darted out from what had seemed the end of it, the tip of which was enlarged and tripartite, having, as it were, three lips, which pressed upon the exposed surface of the pistil or ovary of the flower. It then shot back, and this process was repeated, at intervals, two or three times, the instrument being, no doubt, employed, when I did not see it, in searching some part of the calyx that had not been laid bare. The bee, now, slowly and with great difficulty—in the most decrepit manner imaginable—crawled out of the foxglove, over another, and into the one next it, where, again, upon using the scissors, I saw the proboscis at work. Then, coming out once more, it just managed to get on to the mouth of another blossom—a short one—where it clung, seeming to be on the point of death.

Here, then, we have two instances of bees, not ordinarily in the habit of entering foxgloves, doing so whilst in a state which, whether it precedes death or not, is not, at any rate, a normal one. In one of these cases, however, and therefore, presumably, in the other also, not only has the bee entered the cups, but, as we have seen, it has crawled up to their ends, and extracted the juices of the flower, as do those who habitually obtain them in

this way. It would seem, therefore, that there may be a curious change in a bee's life-habits, consequent upon the approach of a lethargy which may or may not precede death. The primary instinct or habit, however—that of extracting nectar from the flower—remains unmodified, and supposing that this last bee really was dying, then, so far from feeling or providing for its approaching dissolution, we see it continuing at its work as long as ever its strength will allow it to, and expending its last energy either in rifling the flower it is in, or endeavouring to get to another, in order to do so—a strong instance of “the ruling passion” being strong in death.

But why should there, now, be a change in the method of rifling the flower? Although, as I have said, one may watch bees that habitually do not enter foxgloves, for a very long time, and for many days in succession, without seeing them do so, yet it seems reasonable to conclude that this more obvious process, which allows of every flower being ransacked, before its corolla has either been shed or perforated, was the first one employed by all species, and that the others represent departures from it. If this be so, then it would appear that the lethargy, however induced, under which a bee whose individual habits have thus come to differ from its ancestral ones, is labouring, produces a mental disturbance which, in some cases, may take the form of a reversion to these earlier habits. If so, then we have here a principle through which light might be thrown upon the course of evolution, not only in bees, but also in some other insects, or species, belonging to other divisions of the animal kingdom.

I subsequently introduced a lethargic bee belonging to one of the species, which does not habitually enter the flowers of the foxglove, into one, on which she crawled painfully up it, and on my cutting the base of the tube with the scissors, as before, I saw her proboscis several times shot out, as in the former case. She then came out, and I put her into several others, which she each time vacated, and then, seeming to take a new lease of life and energy, whirled her wings, and flew away. Watching her movements, however, I saw that there was something peculiar about them. She flew in an aimless and, as it were, confused sort of way, mostly in circles, and faster than usual. In this

manner she buzzed round some of the foxgloves, but without alighting or slackening speed, to alight, then made a wide circuit or two, high up, and, at last, flew right into the fir forest surrounding these open spaces, which I have never before, if I remember, seen a bee here do.

Thus it seems clear that, with the coming on of this drowsiness, the psychology of the bee is affected, and though we may not exactly see why, yet it is not inconceivable that such mental disturbal may produce a reversion to past ancestral habits, in which category entering the cup of the foxglove, in order to extract the nectar, would fall, in the case of a bee that was not accustomed to do this, if we suppose that such entry was the primitive method adopted, and that the others of probing the tube from without, or visiting those flowers only that had shed their corollas, were deviations from it, subsequently arising. In illness, and also in old age, the mind is often filled with the memories of childhood, and though the reversion here is only to one's past, still it is a reversion, and may be governed by the same laws as obtain in the other. Drowning, again, is apparently attended by the same phenomenon. I am assuming, of course, that the bee's individual habits have always been the same. Otherwise, the analogy offered by the above cases would be much closer, if not exact.

As the bees do not either bite through the neck of the foxglove with their mandibles, or pierce it with their proboscis, to what agency are the holes which they find ready-made there attributable? On several occasions I had noticed a small Longicorn, or Longicorn-like beetle, in this situation, and I thought, though I could not be quite sure, that one of these was biting at the neck of the foxglove, inside which he was. Longicorns, at any rate, are, I believe, vegetarians, and as this one seems to live largely on the foxglove, it is probable that it does so in a double sense. Though small, this beetle is not so very small—as large, perhaps, though the shape is different, as the house-fly and there is at least one larger species whose habits appear to be the same. Through the lens, the mandibles of both look very well adapted for making these little holes in the walls of flowers. They are long and sharply pointed, finely though

strongly made, and somewhat sickle-shaped. Thus, then, supposing these beetles to be the makers of the holes in question, we have, at least, three species of Humble-Bee taking advantage of their handiwork to insert their proboscis through the basal part of the corolla of the foxglove, from without, instead of entering it, which it does not appear to be their habit to do.

Assuming that the ancestors of those bees that do not now enter the foxglove flowers, in order to rifle them, were in the habit of doing so, what, if any, has been the gain to the species, through which this change of habit has been brought about? Saving of time is the only one that I can imagine, and certainly a bee that descends directly on those parts of the flower where the juices which she covets reside, can sooner obtain them than one who comes down farther off, by the length of the long tunnel, formed by the corolla, up which she has first to climb. But, on the other hand, a bee which flies from one such tunnel to another, looking for holes in them, through which it can thrust its proboscis, which holes it does not always find, would seem to be losing time; yet this is what I have seen many bees doing. Here it would depend on how numerous such holes were, and, in regard to this, they must have been fairly numerous, one would think, for such a habit to have arisen at all. Still, though, here and there, almost every foxglove seemed perforated, in this way, over any large area, they formed, I believe, but a small minority. Possibly the bee may be aided here by its eyesight, yet it was common for them to settle on the necks of unperforated tubes, from which they had to fly, bootless, away. These bees certainly lost time, but they might, perhaps, more than make up for this by a succession of successful alightments, of which I also saw many instances.

Bees that search the foxgloves in this way, rifle, also, those flowers which have lost their corollas, yet I have seen individuals going so continuously from tube to tube, to probe them from without, that one would not have supposed that they did anything else, and this was particularly the case with one species, the small black Humble-Bee, with a yellow-tipped abdomen—*B. mort-nucatus* namely—which I have mentioned. I am not, indeed, quite sure that the latter does not feed exclusively in this manner

—I mean, of course, when visiting the foxglove. Even if we suppose this bee to be very quick in noticing these small perforations in the neck of the corolla—which would not, however, look so small to it—yet it has to miss a number of flowers, whereas the bee who enters them can rifle every one. *B. terrestris*, also, though alighting sometimes on the naked calyx, yet certainly, through the same cause, misses a number of blossoms. It would seem, therefore, that the change from the orthodox way, as we may call it, of obtaining nectar from the foxglove, to the ones we are considering, must represent a loss rather than a gain of time, and this should make us doubt whether any such change has taken place. Of course, if the proboscis of any of these bees were not sufficiently long to be effectually employed from within the tube, the whole philosophy of the matter would be changed, and the possibility of any such evolution, as is here imagined, be excluded, in their case. But how can this be? The part of the foxglove which has to be reached is the moist green base, more or less swollen, of the pistil, and this does not appear to be so tightly enclosed within the tube of the corolla but that a bee, whose proboscis was not altogether abnormal, might press up, so as to reach it, without undue difficulty. Both *B. mastrucatus* and the small brown bee might, I think, very well do this, and it is probably what that individual of the latter species—the smaller of the two—that I found in one of the “gloves” was doing. *B. terrestris*, in any case, which here rarely enters the corolla, but either probes it from without or licks the corolla-less pistils, can, as has been seen, with the greatest ease, put its proboscis to a like use within the tube. Yet, in spite of its being under no physical disability of rifling the foxglove in the ordinary manner (as in England), and though it does occasionally do so, yet this bee, where I have watched it, in the Black Forest, habitually obtains the nectar through perforations that have been previously made in the corolla, passing by such as are not thus perforated. The presumption, I think, is that it has changed its earlier habits in this respect, and, if so, this is probably also the case with the two smaller kinds. Must we therefore conclude that the change has been beneficial to the species? This does not appear to me to be a necessary inference, and, were foxgloves the only flowers, one might rather

suppose the contrary, since the two species that search them, most constantly, in the regular manner, are much more numerous, where they abound, than those whose habits have been modified. If no conclusion can be drawn from this circumstance, yet I am unable to see what gain can accrue, from such a change, to the species, though it may mean less trouble to the individual. But nations that have become effete on this principle have not disappeared at once, and there should be ample time to observe the deleterious variations in the habits of a species, before these have cost it its life.

The above observations were made by me from August 18th to 26th, and were confined to a particular patch of foxgloves in that part of the Black Forest where I was staying. From some earlier ones made in other and much smaller patches, it has occurred to me that the flower-searching habits of the same species of *Bombus* may differ locally, by which I mean in places only a short distance apart. As the worker bees do not go a very great way from the nest, and as the fertilized queen probably does not do so either, this is not, in itself, less improbable than that different dialects of a language—*e. g.* Norwegian—should have grown up in valleys quite near to, but cut off, by high intervening mountains, from, one another. In neither case can the inhabitants of neighbouring districts intermix, which is the condition above all requisite for divergence both of habit and speech. Since, however, my previous observations were made, casually, when my mind was occupied with another subject, and were not noted down at the time, I only mention this as a matter of possibility, which it might be worth while to investigate.

I do not recall having ever, in England, seen a Humble-Bee obtaining the nectar of the foxglove otherwise than by entering the flower—but foxgloves are not common in England. As Darwin, however, mentions bees being sometimes in such a hurry to rifle flowers as to bite holes through their corollas, I will here once more say that, to the best of my observation and belief, these bees of the Schwarzwald never did so whilst searching the foxglove beds. Not only did they leave such flowers as were not already perforated, but such perforations as they utilized, showed, by their discoloured edges, that they had not

been made by themselves.* This, of course, would not exclude the agency of a previous bee, but why should one individual depend on another for what it could equally well do itself? Moreover, the biting of a hole, by a bee, in any flower that it can reach by entry, would appear to be a very doubtful method of saving time. A previously perforated foxglove would, however, enable it to save trouble, and in this we probably have the real motive of action. By counting the number of foxglove flowers searched, in a given time, by representatives of each method, it would be possible, perhaps, to find out whether this saving of trouble is synonymous with saving of time. Should it, however, appear that the non-foxglove-entering bees worked less quickly than the others, this would not quite settle the question, since the factors of duration of labour and amount of rest required would still remain to be considered. To wedge itself up one narrow tube, after another, must certainly be greater labour for a bee than flight between flower and flower; greater labour must require a greater amount of relaxation from it, and I have seen Humble-Bees, which were not in a lethargic condition, sitting, for some while, motionless, as though resting.

* As bearing on this question, I may mention that various Humble-Bees that I confined inside foxgloves, by tying up the mouth with cotton, remained prisoners, for a long time, before they began to bite the corollas in order to force their way out, which was such a labour to them that some on emerging lay, for a time, motionless, as if exhausted. This may not *prove* that it is not their custom to bite through foxgloves, from without, but it does not favour that view. There would, however, be nothing extraordinary in the fact of bees that once bit their way into foxgloves having now become dependent on the work of other insects, in this respect. Ants, now fed by slave ants, once fed themselves, and can still do so to some extent, and (if I am not mistaken) in differing degrees. In this connection the facts here recorded become all the more interesting.

NOTES FROM YORKSHIRE.

BY E. P. BUTTERFIELD.

QUITE recently Mr. J. W. Carter, F.E.S., of Bradford, sent me a few dead bees (*Bombus* sp.) which he had picked up beneath the blossoms of some lime-trees in Patterdale, in the Lake District, all of which had neat holes in the thorax and abdomen, from which the contents had been abstracted. About a year ago a gamekeeper told me he had witnessed a similar occurrence under an avenue of lime-trees in this district; all the bees which he examined had apparently met with their death in a similar manner to the specimens sent by Mr. Carter.

The late Mr. James Varley, of Huddersfield, recorded a similar phenomenon in the 'Naturalist,' vol. iii. p. 40. He mentions having found hundreds of dead bees under lime-trees on his way to Woodsome. These were sent to the late Mr. Frederick Smith, of the British Museum, and he suggested the probability of their having met with their death by the Red-backed Shrike, which seems to have a partiality for bees.

The Red-backed Shrike is what might be considered practically absent from this district, and so cannot be responsible for the cause of the deaths mentioned by the gamekeeper referred to above. The more probable culprit, I think, will turn out to be one of the Tit family, probably either the Blue or Great Tit, both of which are found in abundance in this district.

There should be no great difficulty in ascertaining the cause of such havoc among bees; that it is due to some species of bird or birds I have little doubt, although it has been suggested that dead bees found under lime-blossoms might have been poisoned, and the perforation in their bodies been due to ants, &c.*

A friend of mine near Keighley has been wanting me now for some time to pay a visit to a Starling roost near his residence.

* Six specimens of *Bombus lucorum* from Gloucestershire were sent by Dr. Günther to the British Museum for identification. They had been taking honey from *Tilia petiolaria*, the flowers of which attract them, and, having apparently become stupefied, they had been attacked by wasps, which had made holes in the thorax.—ED.

He informs me that every evening, not only thousands but actually millions assemble, and have done for some time. Soon after the young left their nest this season, I saw the largest flock it has ever been my privilege to witness. Probably no British bird has multiplied so rapidly within recent years as this species, and wherever I have visited within a radius of ten or twenty miles of this village (Wilsden) it is found to be chiefly single-brooded. This is easily ascertainable where it breeds in colonies. The Siberian form predominates here, and it would be interesting to ascertain where this species is said to be double-brooded, and whether it is the old English form. For some reason there has been this year a relatively larger proportion of late broods. One reason may be: they began to breed somewhat earlier owing to the fine spell of weather in March. This might have induced a few to attempt a second brood, but I should think most of the late broods had their first nests destroyed.

On or about August 12th two boys told me they had found a Snipe's nest the previous day in a situation the least likely for this species of any in the district. On account of the late date and unlikely place for the nest of this bird, I thought the boys must be mistaken. However, my informants were quite right. I found it to be the nest of a Snipe with one egg in an advanced stage of incubation. The old bird flushed off when only within a few feet from its nest. Probably it had had its first, and possibly its second, nest destroyed.

Of late years hereabouts a shrub (*Daphne*) has been much cultivated by gardeners, and its berries have a great attraction for Greenfinches. They eat the seeds only, rejecting the pulpy mass, and these birds, which are so shy at other times, will come into our main streets and feed upon these berries within a few feet of passengers. I have never seen any other species of birds feeding upon these berries. This partiality of birds for certain berries and other fruits is an interesting question. The Bullfinch is a very rare breeding species in this neighbourhood, but when the elderberries are ripe I can always count upon seeing it. Ring-Ouzels are very fond of bilberries, and also very partial to the berries of the mountain-ash, and come from the moors in some numbers when these berries are ripe. Starlings and Mistle-Thrushes are both fond of rowan-berries.

NOTES AND QUERIES.

A V E S.

Nightingale and Willow-Wren in Captivity. — I had recently a great treat, being taken by a friend to see a collection of foreign and British birds kept by a German working man in a small attic over his workroom in a house in the town, and was surprised to see all the birds in such perfect health and plumage, for they had only a minimum of light and scarcely any sunshine. I was particularly interested in a Nightingale kept for three years, and also a Willow-Wren, lively and active, hopping about as if in its native haunts, and so tame that both took wasp-grubs from the hand. There were also a large number of rare and valuable foreign birds, all in fine plumage and health, a pair of Hoopoes, and a pair of Grey Wagtails. —ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Albino House-Sparrow in Yorkshire.—On August 24th last Miss Grimshaw, of Eden Place, Ackworth, in the West Riding of Yorkshire, showed me a beautiful example of an albino House-Sparrow (*Passer domesticus*) which had just previously been killed by her cat. There was no colouring matter whatever in the plumage, tarsi, toes, claws, or beak, which were pure white. The carcase was fortunately not damaged, and the bird was sent to Mr. Cullingford, of Durham, to preserve, and on dissection it was found to be a male. —WALTER B. ARUNDEL (High Ackworth, Pontefract).

Late Eggs of Nightjar (*Caprimulgus europæus*): Was it a Second Brood?—The present abnormal summer, with its autumn-like days and nights, may account for almost any irregularity we may observe in the economy or occurrence of birds, insects, or plants, and I am aware that the occasional double-broodedness of this peculiar summer-loving bird is an open question; consequently the following note may be of interest:—On Aug. 15th I had two eggs sent me, which had been picked up the day previously on exactly the same spot where a pair of birds had been hatched and reared in the early part of the season—I think in June. The two eggs in question were perfectly fresh, the yolks were intact, and without the least indication

of having been incubated, although one of the birds—presumably the female—rose from the spot when approached. One of the eggs was of a generally lighter colour, from the fact of the two shades of markings being very much paler than usual, as if the parent had lacked the full amount of colouring pigment. Of course, I am not at all sure that the two young birds and the eggs belonged to the same parents, but I believe it is often observed that, like others of the Swallow kind, this species, if undisturbed, will return more than once to the same nesting-place, and, as the former hatching proved successful, a second brood may have been anticipated from the same quarters; and, on the other hand, it may have been only a coincidence, in which two pairs of birds chose the same site for their home; but in either case it seems to me somewhat strange that a bird should attempt to rear a family so near to its departure to a warmer clime, where, if observation is correct, they neither marry nor are given in marriage, a forcible proof that they love the land of their nativity, though they wander far. From what I heard, the birds have been seen in some numbers during the past season, and their “gurglings” were very frequent, notwithstanding the chilly evenings. With regard to late broods of migrating species, we know that the instinct of migration is so strong in the House-Martin that a nest of late young is sometimes left to starve, if, indeed, the supposition of neglect is correct. Is it not possible in such a case that the parents themselves have succumbed to starvation, or have been ruthlessly slain?—G. B. CORBIN (Ringwood, Hants).

A Variety of the Gannet (*Sula bassana*).—Upon a recent visit to the Bass Rock, I saw a very interesting and handsome variety of the Gannet. The whole of the head and neck was of a rich dark buff colour, the back thickly mottled with large crescent-shaped markings of the same rich colour, and the wings were mottled with spots, though not so large or so dark as those on the back. The primaries, feet, legs, beak, and eyes were of normal colour. The bird was mature, and had mated with one of the normal colour, and both were mounting guard over their solitary young one. I obtained several photographs of the bird. Out of the many thousands of birds frequenting the Rock, this was the only one I saw which departed in any way from the normal.—R. FORTUNE (5, Grosvenor Terrace, East Parade, Harrogate).

Early Building of Herons.—In some seasons Herons begin building very early. In 1896 they began building in a small wood at Moy View, Co. Sligo, on January 15th, several pairs were hatching on

February 1st, by the end of the month the young in the nests were heard calling loudly and strongly for food, and by February 8th all in that wood were apparently hatched. They generally begin building in that locality in February, but January 15th was the earliest date that has come under my notice since the birds came to the wood over forty years ago. — ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Hérons breeding twice in the Season.—For many years, seeing very young Herons in July and August, I was puzzled as to whether these birds really reared two broods, or whether the late young birds were the produce of parents that had lost their first clutch of eggs or young by the nests being blown down during the March storms. However, in May, 1896, my doubts were cleared. Within sixty yards of Moy View Cottage, in the spring of 1896, a pair of Herons built a nest in a tree alongside the path leading from the house to the shore, and were daily under our notice while hatching and rearing their young; these were fully fledged by the end of April. On May 7th we observed the old birds beginning to build a second nest in a fir-tree in the garden about thirty yards from a bedroom window, but the second day I was attracted by a great noise, as if the birds were scolding or fighting. However, on going out to the garden, I found that the young birds had followed the old ones to where they were at the new nest, and the uproar was caused by the young ones persistently following the old birds and calling for food, and by the old birds scolding and driving the young ones away from the new nest. So here the doubts as to a second brood were solved by seeing the young of the first nest following and annoying their parents by clamouring for food when they should have been feeding themselves. —ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Correction.—Mr. Owen wishes to make a correction to his recent communication, “An Account of a Ramble with the Birds in Anglesey and Carnarvonshire” (*ante*, p. 310). For “Anglesey” (top line, p. 311) substitute “a small village in Carnarvonshire.”

NOTICES OF NEW BOOKS.

The Subantarctic Islands of New Zealand; Reports on the Geophysics, Geology, Zoology, and Botany, &c. Edited by CHARLES CHILTON, M.A., D.Sc., &c. Published by the Philosophical Institute of Canterbury, Wellington, N.Z. London: Dulau & Co., Ltd.

THE scientifically unexplored islands of the world are becoming fewer, and the surface of the planet on which we live is rapidly losing its secrets so far as fauna and flora are concerned. The islands which have afforded the subject-matter for these two truly biological volumes were till recently better known as spots visited by whalers, or the inhospitable scenes of not a few shipwrecks; owing, however, to the enterprise and incitement of the Philosophical Institute of Canterbury, and the wisdom of the New Zealand Government, they have now been included in our ever-increasing faunistic records by the work of a scientific party landed on the Auckland and Campbell Islands during the annual trip of the Government steamer 'Hinemoa' in November, 1907.

This publication is a very thorough production, and an ample historical Introduction is given, including "The Discovery of the Islands," by the Hon. R. McNab, and a detailed account of "The Subantarctic Islands of New Zealand and the History of their Scientific Investigation," by Dr. Charles Chilton, the latter contribution being fully illustrated and intensely readable. As may be expected, the subject-matter of the two volumes is the work of specialists, and is descriptive of the material collected during the expedition. The insects collected by the Campbell Island party were mostly Coleoptera and Diptera, and we are told by Mr. Hudson that, "owing to the prevailing heavy winds, the insects at Campbell Island fly very little, and unless they are captured whilst at rest on some plant it is

almost impossible to net them, as the wind picks them up the moment they leave the flower, and whirls them away some ten or twenty feet." Major T. Broun, who has worked out the Coleoptera, has formed the following conclusion:—"Assuming that a considerable area of land formerly extended from the Auckland Islands towards Patagonia, the New Zealand Islands must have formed a portion of it." Mr. H. R. Hogg, from a study of the *Arachnidæ*, has formed a similar opinion:—"The supposition of an ancient land-link between South America, Australia, and Southern Africa is more or less of a necessity in order to account for the present distribution of creatures which it is difficult to believe could have reached their respective habitats by any other means."

Mr. E. R. Waite has dealt with the vertebrates. "There are no reptiles on the islands." The mammalian fauna is small, and represented by "species of cetaceans, by two kinds of resident Seals, and occasional visitors or stragglers of the order." The account of the birds is stated to be very inadequate for several reasons, one of which was a rule of the expedition that neither birds nor their eggs were to be taken. The Albatrosses *Diomedea exulans* and *D. regia* and the Mollymawk (*D. melanophrys*) breed on the islands, and some fine photographs of these birds and their nests are given. The "Flightless Duck" (*Nesonetta aucklandica*) is rather misnamed, as, according to Capt. Bollons, "these ducks are able to fly for short distances, and, as a matter of fact, they reach their nesting-sites by this means." The most interesting discussion in the description of the fishes is the disinclination of Mr. Waite to accept *Galaxias brevipinnis* as a marine species, as it is considered by some very high authorities. Dr. Chilton has fully enumerated and described the Crustacea. One interesting fact in this communication relates to the genus *Parorchestia*. The male of *P. sylvicola* on the main islands of New Zealand is very rare, nearly all the specimens captured being females; yet in the three species of the genus found on the Auckland and Campbell Islands the males appear to be almost as abundant as the females.

The botanical and geological sections do not appertain to our pages, and we have been unable to refer to the contributions

of all the specialists in these volumes. Enough, however, has surely been noticed to prove the importance to zoologists of the results of this somewhat short but important expedition.

Life of William Macgillivray. By WILLIAM MACGILLIVRAY, with a scientific appreciation by Prof. J. ARTHUR THOMSON. John Murray.

It is well that we should know more of the life of this devoted ornithologist, well described by Darwin as "the accurate Macgillivray," and the first half of the volume which is devoted to biographical details gives us all the principal events comprised in a busy life, even if it does not present the personal characteristics that lift a biography into a human document. We can, however, glean much of the man himself in the narrative of his work; his could have been no nebulous personality to have drawn to his lectures so fine a judge of style and matter in other fields as the late Prof. Blackie. Besides attempting to found a permanent classification of birds on structural characters, he anticipated our modern bird-watchers. "Much of his holiday time was spent in watching, by night as well as by day, the habits of birds, and he often concealed himself for many hours continuously, now in some cave or rocky recess by the shore, from which the variety of swimming birds could be most readily seen, and again in some temporary shelter erected on the higher cliffs, from which the Eagle, the Osprey, the Raven, and other predatory birds could be closely observed." His walk from Aberdeen to London in order to see the British Museum and other kindred institutions is a narrative of Scottish frugality and endurance adorned by natural reflections and appreciations of events and scenery which come not to every pedestrian.

Besides being an ornithologist, Prof. Thomson, in his appreciation, acutely points out that Macgillivray was one of that now almost extinct type—the all-round naturalist—that he was a well-equipped geologist, botanist, and zoologist, and that "he taught all the three sciences with conspicuous success." These qualities must have made him appreciate the wide intellectual purview of Alexander von Humboldt, whose published travels and researches he condensed, a memorable classic, containing some

mistaken conclusions based on imperfect data but not on ignorance of the knowledge of the day. Humboldt's encyclopædic attainments must have won the admiration of Macgillivray.

Eight illustrations of birds drawn by Macgillivray, and now contained in the British Museum, are reproduced in this volume, and add to its attraction. Misprints appear to be few, though in the preface we notice that Mr. Pycraft has had an extra vowel added to his name. We have also been somewhat in doubt as to the proper way to write the name of this great British ornithologist. On the title-page it appears twice as "Macgillivray"; throughout the volume it is written "MacGillivray." Rightly or wrongly, we have followed the title-page.

Faune des Mammifères d'Europe. Par E.-L. TROUESSART.
Berlin: R. Friedländer & Sohn.

In his preface Prof. Trouessart compares the evolutionary views of to-day with those of the immutability of species at the time (1857) when Blasius published his 'Naturgeschichte der Säugethiere Deutschlands und der angrenzenden Länder von Mitteleuropa.' At that time Blasius followed the doctrine of Cuvier; to-day, in a similar undertaking, Trouessart writes as a disciple of Darwin. Four principal divisions are recognized in this fauna:—(1) "La faune de l'Europe Centrale, la moins caractérisée de toutes, attendu qu'elle ne présente que les espèces vulgaires, généralement répandues sur tout le Continent." (2) "La faune Arctique caractérisée par *Ursus maritimus*, *Canis lagopus*, *Gulo borealis*, *Lepus timidus* (ou *variabilis*), *Rangifer tarandus*, *Alce alces*, &c. À l'Epoque Glaciaire cette faune s'est avancée jusqu'aux Pyrénées." (3) "La faune des Steppes Asiatiques, caractérisée surtout par ses Rongeurs des genres *Citellus*, *Gerbillus*, *Cricetus*, *Cricetulus*, *Spalax*, *Dipodipus*, *Alactaga*, *Ochotona*, &c.; cette faune, que vit encore dans le Sud-Est de la Russie, s'est avancée jusque dans le centre de l'Europe pendant la période de sécheresse qui succède à l'Epoque Glaciaire, et y a laissé des survivants, par exemple, *Cricetus cricetus* (le Hamster)." (4) "Enfin la faune Africaine ou Méditerranéenne, caractérisée par *Genetta vulgaris*, *Herpestes ichneumon*, *Canis*

aureus, *Felis ocreata*, *Hystrix cristata*, *Lepus mediterraneus*, &c., semble un résidu de la faune de l'Epoque Tertiaire."

In the treatment of species a binomial and analytical method is employed. The genus *Mus* is liberally treated, though *M. flavicollis*, Melch., is not considered as distinct from *M. sylvaticus*, as recently advocated by a writer in these pages. But all these different representatives of *Mus*, whether regarded as species, varietal or geographical forms, are clearly diagnosed and their localities detailed. Difference of view on these questions seems to be as clearly found among mammalogists as among other zoological specialists, and will probably continue as the classificatory pendulum sways between the analytic and synthetic foundations.

Prof. Trouessart's volume will sustain the reputation of its writer; it is published at a time when we believe other works of a similar or somewhat similar character will also shortly appear.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SHEFFIELD, 1910.

ADDRESS TO THE ZOOLOGICAL SECTION.

By Professor G. C. BOURNE, M.A., D.Sc., F.R.S., *President of the Section.*

IN choosing a subject for the address with which it is my duty, as President of this Section, to trouble you, I have found myself in no small embarrassment. As one whose business it is to lecture and give instruction in the details of comparative anatomy, and whose published work, *qualecunque sit*, has been indited on typical and, as men would now say, old-fashioned morphological lines, I seem to stand self-condemned as a morphologist. For morphology, if I read the signs of the times aright, is no longer in favour in this country, and among a section of the zoological world has almost fallen into disgrace. At all events, I have been very frankly assured that this is the case by a large proportion of the young gentlemen whom it has been my fate to examine during the past two years; and, as this seems to be the opinion of the rising generation of English zoologists, and as there are evident signs that their opinion is backed by an influential section of their elders, I have thought that it might be of some interest, and perhaps of some use, if I took this opportunity of offering an apology for animal morphology.

It is a sound rule to begin with a definition of terms, so I will first try to give a short answer to the question, "What is morphology?" and, when I have given a somewhat dogmatic answer, I will try to deal in the course of this address with two further questions: What has morphology done for zoological science in the past? What remains for morphology to do in the future?

To begin with, then, what do we include under the term morphology? I must, first of all, protest against the frequent assumption that we are bound by the definitions of C. F. Wolff or Goethe, or even of Haeckel, and that we may not enlarge the limits of morphological study beyond those laid down by the fathers of this branch of our science. We are not—at all events, we should not be—bound by authority, and we owe no allegiance other than what reason commends to causes and principles enunciated by our predecessors, however eminent they may have been.

The term morphology, stripped of all the theoretical conceptions that have clustered around it, means nothing more than the study of form, and it is applicable to all branches of zoology in which the relationships of animals are determined by reference to their form and structure. Morphology, therefore, extends its sway not only over the comparative anatomy of adult and recent animals, but also over palæontology, comparative embryology, systematic zoology and cytology, for all these branches of our science are occupied with the

study of form. And in treating of form they have all, since the acceptance of the doctrine of descent with modification, made use of the same guiding principle—namely, that likeness of form is the index to blood-relationship. It was the introduction of this principle that revolutionized the methods of morphology fifty years ago, and stimulated that vast output of morphological work which some persons, erroneously as I think, regard as a departure from the line of progress indicated by Darwin.

We may now ask, What has morphology done for the advancement of zoological science since the publication of the 'Origin of Species'? We need not stop to inquire what facts it has accumulated: it is sufficiently obvious that it has added enormously to our stock of concrete knowledge. We have rather to ask, What great general principles has it established on so secure a basis that they meet with universal acceptance at the hands of competent zoologists?

It has doubtless been the object of morphology during the past half-century to illustrate and confirm the Darwinian theory. How far has it been successful? To answer this question we have to be sure of what we mean when we speak of the Darwinian theory. I think that we mean at least two things. (1) That the assemblage of animal forms as we now see them, with all their diversities of form, habit, and structure, is directly descended from a precedent and somewhat different assemblage, and these in turn from a precedent and more different assemblage, and so on down to remote periods of geological time. Further, that throughout all these periods inheritance combined with changeability of structure have been the factors operative in producing the differences between the successive assemblages. (2) That the modifications of form which this theory of evolution implies have been rejected or preserved and accumulated by the action of Natural Selection.

As regards the first of these propositions, I think there can be no doubt that morphology has done great service in establishing our belief on a secure basis. The transmutation of animal forms in past time cannot be proved directly; it can only be shown that, as a theory, it has a much higher degree of probability than any other that can be brought forward, and in order to establish the highest possible degree of probability, it was necessary to demonstrate that all anatomical, embryological, and palæontological facts were consistent with it. We are apt to forget, nowadays, that there is no *a priori* reason for regarding the resemblances and differences that we observe in organic forms as something different in kind from the analogous series of resemblances and differences that obtain in inanimate objects. This was clearly pointed out by Fleeming Jenkin in a very able and much-referred to article in the 'North British Review' for June, 1867, and his argument from the *a priori* standpoint has as much force to-day as when it was written forty-three years ago. But it has lost almost all its force through the arguments *a posteriori* supplied by morphological science. Our belief in the transmutation of animal organization in past time is founded very largely upon our minute and intimate knowledge of the manifold relations of structural form that obtain among adult animals; on our

precise knowledge of the steps by which these adult relations are established during the development of different kinds of animals; on our constantly increasing knowledge of the succession of animal forms in past time; and, generally, on the conviction that all the diverse forms of tissues, organs, and entire animals are but the expression of an infinite number of variations of a single theme, that theme being cell-division, multiplication, and differentiation. This conviction grew but slowly in men's minds. It was opposed to the cherished beliefs of centuries, and morphology rendered a necessary service when it spent all those years which have been described as "years in the wilderness" in accumulating such a mass of circumstantial evidence in favour of an evolutionary explanation of the order of animate nature as to place the doctrine of descent with modification on a secure foundation of fact. I do not believe that this foundation could have been so securely laid in any other way, and I hold that zoologists were actuated by a sound instinct in working so largely on morphological lines for forty years after Darwin wrote. For there was a large mass of fact and theory to be remodelled and brought into harmony with the new ideas, and a still larger vein of undiscovered fact to explore. The matter was difficult and the pace could not be forced. Morphology, therefore, deserves the credit of having done well in the past: the question remains, What can it do in the future?

It is evident, I think, that it cannot do much in the way of adding new truths and general principles to zoological science, nor even much more that is useful in the verification of established principles, without enlarging its scope and methods. Hitherto—or, at any rate, until very recently—it has accepted certain guiding principles on faith, and, without inquiring too closely into their validity, has occupied itself with showing that, on the assumption that these principles are true, the phenomena of animal structure, development, and succession receive a reasonable explanation.

We have seen that the fundamental principles relied upon during the last fifty years have been inheritance and variation. In every inference drawn from the comparison of one kind of animal structure with another, the morphologist founds himself on the assumption that different degrees of similitude correspond more or less closely to degrees of blood-relationship, and to-day there are probably few persons who doubt that this assumption is valid. But we must not forget that, before the publication of the 'Origin of Species,' it was rejected by the most influential zoologists as an idle speculation, and that it is imperilled by Mendelian experiments showing that characters may be split up and reunited in different combinations in the course of a few generations. We do not doubt the importance of the principle of inheritance, but we are not quite so sure as we were that close resemblances are due to close kinship and remoter resemblances to remoter kinship.

The principle of variation asserts that like does not beget exactly like, but something more or less different. For a long time morphologists did not inquire too closely into the question how these differences arose. They simply accepted it as a fact that they occur,

and that they are of sufficient frequency and magnitude, and that a sufficient proportion of them lead in such directions that natural selection can take advantage of them. Difficulties and objections were raised, but morphology on the whole took little heed of them. Remaining steadfast in its adherence to the principles laid down by Darwin, it contented itself with piling up circumstantial evidence, and met objection and criticism with an ingenious apologetic. In brief, its labours have consisted in bringing fresh instances, and especially such instances as seemed unconformable, under the rules, and in perfecting a system of classification in illustration of the rules. It is obvious, however, that, although this kind of study is both useful and indispensable at a certain stage of scientific progress, it does not help us to form new rules, and fails altogether if the old rules are seriously called into question.

As a matter of fact, admitting that the old rules are valid, it has become increasingly evident that they are not sufficient. Until a few years ago morphologists were open to the reproach that, while they studied form in all its variety and detail, they occupied themselves too little—if, indeed, they could be said to occupy themselves at all—with the question of how form is produced, and how, when certain forms are established, they are caused to undergo change and give rise to fresh forms. As Klebs has pointed out, the forms of animals and plants were regarded as the expression of their inscrutable inner nature, and the stages passed through in the development of the individual were represented as the outcome of purely internal and hidden laws. This defect seems to have been more distinctly realised by botanical than by zoological morphologists, for Hofmeister, as long ago as 1868, wrote that the most pressing and immediate aim of the investigator was to discover to what extent external forces acting on the organism are of importance in determining its form.

If morphology was to be anything more than a descriptive science, if it was to progress any further in the discovery of the relations of cause and effect, it was clear that it must alter its methods and follow the course indicated by Hofmeister. And I submit that an inquiry into the causes which produce alteration of form is as much the province of, and is as fitly called, morphology as, let us say, a discussion of the significance of the patterns of the molar teeth of mammals or a disputation about the origin of the coelomic cavities of vertebrated and invertebrated animals.

There remains, therefore, a large field for morphology to explore. Exploration has begun from several sides, and in some quarters has made substantial progress. It will be of interest to consider how much progress has been made along certain lines of research—we cannot now follow all the lines—and to forecast, if possible, the direction that this pioneer work will give to the morphology of the future.

I am not aware that morphologists have, until quite recently, had any very clear concept of what may be expected to underlie form and structure. Dealing, as they have dealt, almost exclusively with things that can be seen or rendered visible by the microscope, they have acquired the habit of thinking of the organism as made up of organs, the organs of tissues, the tissues of cells, and the cells as

made up—of what? Of vital units of a lower order, as several very distinguished biologists would have us believe; of physiological units, of micellæ, of determinants and biophors, or of pangenes; all of them essentially morphological conceptions; the products of imagination projected beyond the confines of the visible, yet always restrained by having only one source of experience—namely, the visible. One may give unstinted admiration to the brilliancy, and even set a high value on the usefulness, of these attempts to give formal representations of the genesis of organic structure, and yet recognise that their chief utility has been to make us realise more clearly the problems that have yet to be solved.

Stripped of all the verbiage that has accumulated about them, the simple questions that lie immediately before us are: What are the causes which produce changes in the forms of animals and plants? Are they purely internal, and, if so, are their laws discoverable? Or are they partly or wholly external, and, if so, how far can we find relations of cause and effect between ascertained chemical and physical phenomena and the structural responses of living beings?

As an attempt to answer the last of these questions, we have the recent researches of the experimental morphologists and embryologists directed towards the very aim that Hofmeister proposed. Originally founded by Roux, the school of experimental embryology has outgrown its infancy and has developed into a vigorous youth. It has produced some very remarkable results, which cannot fail to exercise a lasting influence on the course of zoological studies. We have learnt from it a number of positive facts, from which we may draw very important conclusions, subversive of some of the most cherished ideas of whilom morphologists. It has been proved by experiment that very small changes in the chemical and physical environment may and do produce specific form-changes in developing organisms, and in such experiments the consequence follows so regularly on the antecedent that we cannot doubt that we have true relations of cause and effect. It is not the least interesting outcome of these experiments that, as Loeb has remarked, it is as yet impossible to connect in a rational way the effects produced with the causes which produced them, and it is also impossible to define in a simple way the character of the change so produced. For example, there is no obvious connection between the minute quantity of sulphates present in sea-water and the number and position of the characteristic calcareous spicules in the larva of a Sea-urchin. Yet Herbst has shown that if the eggs of Sea-urchins are reared in sea-water deprived of the needful sulphates (normally .26 per cent. magnesium sulphate and .1 per cent. calcium sulphate), the number and relative positions of these spicules are altered, and, in addition, changes are produced in other organs, such as the gut and the ciliated bands. Again, there is no obvious connection between the presence of a small excess of magnesium chloride in sea-water and the development of the paired optic vesicles. Yet Stockard, by adding magnesium chloride to sea-water in the proportion of 6 grams of the former to 100 c.c. of the latter, has produced specific effects on the eyes of developing embryos of the Minnow (*Fundulus heteroclitus*): the optic vesicles, instead of

being formed as a widely separated pair, were caused to approach the median line, and in about fifty per cent. of the embryos experimented upon the changes were so profound as to give rise to cyclopean monsters. Many other instances might be cited of definite effects of physical and chemical agencies on particular organs, and we are now forced to admit that inherited tendencies may be completely overcome by a minimal change in the environment. The nature of the organism, therefore, is not all-important, since it yields readily to influences which at one time we should have thought inadequate to produce perceptible changes in it.

It is open to anyone to argue that, interesting as experiments of this kind may be, they throw no light on the origin of permanent—that is to say, inheritable—modifications of structure. It has for a long time been a matter of common knowledge that individual plants and animals react to their environment, but the modifications induced by these reactions are somatic; the germ-plasm is not affected, therefore the changes are not inherited, and no permanent effect is produced in the characters of the race or species. It is true that no evidence has yet been produced to show that form-changes as profound as those that I have mentioned are transmitted to the offspring. So far the experimenters have not been able to rear the modified organisms beyond the larval stages, and so there are no offspring to show whether cyclopean eyes or modified forms of spicules are inherited or not. Indeed, it is possible that the balance of organisation of animals thus modified has been upset to such an extent that they are incapable of growing into adults and reproducing their kind.

But evidence is beginning to accumulate which shows that external conditions may produce changes in the germ-cells as well as in the soma, and that such changes may be specific and of the same kind as similarly produced somatic changes. Further, there is evidence that such germinal changes are inherited—and, indeed, we should expect them to be, because they are germinal.

The evidence on this subject is as yet meagre, but it is of good quality and comes from more than one source.

There are the well-known experiments of Weismann, Standfuss, Merrifield, and E. Fischer on the modification of the colour patterns on the wings of various Lepidoptera.

In the more northern forms of the fire-butterfly, *Chrysophanus* (*Polyommatus*) *phlæas*, the upper surfaces of the wings are of a bright red-gold or copper colour with a narrow black margin, but in Southern Europe the black tends to extend over the whole surface of the wing, and may nearly obliterate the red-gold colour. By exposing pupæ of caterpillars collected at Naples to a temperature of 10° C. Weismann obtained butterflies more golden than the Neapolitan, but blacker than the ordinary German race, and conversely, by exposing pupæ of the German variety to a temperature of about 38° C., butterflies were obtained blacker than the German, but not so black as the Neapolitan variety. Similar deviations from the normal standard have been obtained by like means in various species of *Vanessa* by Standfuss and Merrifield. Standfuss, working with the small tortoiseshell butterfly (*Vanessa urticae*), produced colour aberrations by sub-

jecting the pupæ to cold, and found that some specimens reared under normal conditions from the eggs produced by the aberrant forms exhibited the same aberrations, but in a lesser degree. Weismann obtained similar results with the same species. E. Fischer obtained parallel results with *Arctia caja*, a brightly coloured diurnal moth of the family *Bombycidae*. Pupæ of this moth were exposed to a temperature of 8° C., and some of the butterflies that emerged were very dark-coloured aberrant forms. A pair of these dark aberrants were mated, and the female produced eggs, and from these larvæ and pupæ were reared at a normal temperature. The progeny was for the most part normal, but some few individuals exhibited the dark colour of the parents, though in a less degree. The simple conclusions to be drawn from the results of these experiments is that a proportion of the germ-cells of the animals experimented upon were affected by the abnormal temperatures, and that the reaction of the germ-cells was of the same kind as the reaction of the somatic cells and produced similar results. As everybody knows, Weismann, while admitting that the germ-cells were affected, would not admit the simple explanation, but gave another complicated and, in my opinion, wholly unsupported explanation of the phenomena.

In any case this series of experiments was on too small a scale, and the separate experiments were not sufficiently carefully planned to exclude the possibility of error. But no objection of this kind can be urged against the careful and prolonged studies of Tower on the evolution of chrysomelid beetles of the genus *Leptinotarsa*. *Leptinotarsa*—better known, perhaps, by the name *Doryphora*—is the potato-beetle, which has spread from a centre in North Mexico southwards into the Isthmus of Panama and northwards over a great part of the United States. It is divisible into a large number of species, some of which are dominant and widely ranging; others are restricted to very small localities. The specific characters relied upon are chiefly referable to the coloration and colour patterns of the epicranium, pronotum, elytra, and under side of the abdominal segments. In some species the specific markings are very constant, in others, particularly in the common and wide-ranging *L. decemlineata*, they vary to an extreme degree. As the potato-beetle is easily reared and maintained in captivity, and produces two broods every year, it is a particularly favourable subject for experimental investigation. Tower's experiments have extended over a period of eleven years, and he has made a thorough study of the geographical distribution, dispersal, habits, and natural history of the genus. The whole work appears to have been carried out with the most scrupulous regard to scientific accuracy, and the author is unusually cautious in drawing conclusions and chary of offering hypothetical explanations of his results. I have been greatly impressed by the large scale on which the experiments have been conducted, by the methods used, by the care taken to verify every result obtained, and by the great theoretical importance of Tower's conclusions. I can do no more now than allude to some of the most remarkable of them.

After showing that there are good grounds for believing that
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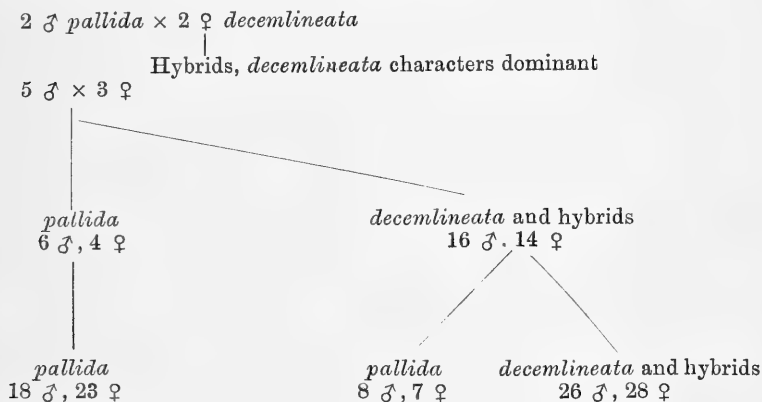
colour production in insects is dependent on the action of a group of closely related enzymes, of which chitinase, the agent which produces hardening of chitin, is the most important, Tower demonstrates by a series of well-planned experiments that colours are directly modified by the action of external agencies—*viz.* temperature, humidity, food, altitude, and light. Food chiefly affects the subhypodermal colours of the larvæ, and does not enter much into account; the most important agents affecting the adult coloration being temperature and humidity. A *slight* increase or a *slight* decrease of temperature or humidity was found to stimulate the action of the colour-producing enzymes, giving a tendency to melanism; but a large increase or decrease of temperature or humidity was found to inhibit the action of the enzymes, producing a strong tendency to albinism.

A set of experiments was undertaken to test the question whether coloration changes induced by changed environmental conditions were inherited, increased, or dropped in successive generations. These experiments, carried on for ten lineal generations, showed that the changed conditions immediately produced their maximum effect; that they were purely somatic and were not inherited, the progeny of individuals which had been exposed to changed conditions through several generations promptly reverting when returned to normal conditions of environment. So far the results are confirmatory of the well-established proposition that induced somatic changes are not inheritable.

But it was found necessary to remove the individuals experimented upon from the influence of changed conditions during the periods of growth and maturation of the germ-cells. Potato-beetles emerge from the pupa or from hibernation with the germ-cells in an undeveloped condition, and the ova do not all undergo their development at once, but are matured in batches. The first batch matures during the first few days following emergence, then follows an interval of from four to ten days, after which the next batch of eggs is matured, and so on. This fact made it possible to test the effect of altered conditions on the maturing germ-cells by subjecting its imagos to experimental conditions during the development of some of the batches of ova and to normal conditions during the development of other batches.

In one of the experiments four male and four female individuals of *L. decemlineata* were subjected to very hot and dry conditions, accompanied by low atmospheric pressure, during the development and fertilization of the first three batches of eggs. Such conditions had been found productive of albinic deviations in previous experiments. As soon as the eggs were laid they were removed to normal conditions, and the larvæ and pupæ reared from them were kept in normal conditions. Ninety-eight adult beetles were reared from these batches of eggs, of which eighty-two exhibited the characters of an albinic variety found in nature and described as a species under the name *pallida*; two exhibited the characters of another albinic species named *immaculothorax*, and fourteen were unmodified *decemlineata*. This gave a clear indication that the altered conditions had produced modifications in the germ-cells which were expressed by colour

changes in the adult individuals reared from them. To prove that the deviations were not inherent in the germ-plasm of the parents, the latter were kept under normal conditions during the periods of development and fertilization of the last two batches of eggs; the larvæ and pupæ reared from these eggs were similarly subjected to normal conditions, and gave rise to sixty-one unmodified *decemlineata*, which, when bred together, came true to type for three generations. The *decemlineata* forms produced under experimental conditions also came true to type when bred together. Of the *pallida* forms produced by experimental conditions all but two males were killed by a bacterial disease. These two were crossed with normal *decemlineata* females, and the result was a typical Mendelian segregation, as shown by the following table:—



This is a much more detailed experiment than those of Standfuss, Merrifield, and Fisher, and it shows that the changes produced by the action of altered conditions on the maturing germ-cells were definite and discontinuous, and therefore of the nature of mutations in De Vries' sense.

In another experiment Tower reared three generations of *decemlineata* to test the purity of his stock. He found that they showed no tendency to produce extreme variations under normal conditions. From this pure stock seven males and seven females were chosen and subjected during the maturation periods of the first two batches of ova to hot and dry conditions. Four hundred and nine eggs were laid, from which sixty-nine adults were reared, constituted as follows:—

Twenty (12 ♂, 8 ♀) . . .	apparently normal <i>decemlineata</i> .
Twenty-three (10 ♂, 13 ♀) . .	<i>pallida</i> .
Five (2 ♂, 3 ♀) . . .	<i>immaculothorax</i> .
Sixteen (9 ♂, 7 ♀) . . .	<i>albida</i> .

These constituted lot A.

The same seven pairs of parents subjected during the second half of the reproductive period to normal conditions gave eight hundred and forty eggs, from which were reared one hundred and twenty-

three adults, all *decemlineata*. These constituted lot B. The *decemlineata* of lot A and lot B were reared side by side under normal and exactly similar conditions. The results were striking. From lot B normal progeny were reared up to the tenth generation, and, as usual in the genus, two generations were produced in each year. The *decemlineata* of lot A segregated into two lots in the second generation. A¹ were normal in all respects, but A², while retaining the normal appearance of *decemlineata*, went through five generations in a year, and this for three successive years, thus exhibiting a remarkable physiological modification, and one without parallel in nature, for no species of the genus *Leptinotarsa* are known which produce more than two generations in the year. This experiment is a sufficient refutation of Weismann's argument that the inheritance of induced modifications in *Vanessa urticae* is only apparent, the phenomena observed being due to the inheritance of two kinds of determinants—one from dark-coloured forms which are phyletically the oldest, and the other from more gaily coloured forms derived from the darker forms. There is no evidence whatever that there was ever a species or variety of potato-beetle that produced more than two, or at the most, and then as an exception, three broods in a year.

The modified albinic forms in this last experiment of Tower's were weakly; they were bred through two or three generations and came true to type, but then died out. No hybridization experiments were made with them, but in other similar experiments, which I have not time to mention in detail, modified forms produced by the action of changed conditions gave typical Mendelian characters when crossed with unmodified *decemlineata*, thus proving that the induced characters were constant and heritable according to the regular laws.

I have thought it worth while to relate these experiments at some length, because they seem to me to be very important, and because they do not appear to have attracted the attention in this country that they deserve.

They are confirmed to a very large extent by the experiments of Professor Klebs on plants, the results of which were published this summer in the Croonian Lecture on "Alterations of the Development and Forms of Plants as a Result of Environment." As I have only a short abstract of the Croonian Lecture to refer to, I cannot say much on this subject for fear of misrepresenting the author; but, as far as I can judge, his results are quite consistent with those of Tower. *Sempervivum funckii* and *S. acuminatum* were subjected to altered conditions of light and nutrition, with the result that striking variations, such as the transformation of sepals into petals, of petals into stamens, of stamens into petals and into carpels, were produced. Experiments were made on *Sempervivum acuminatum*, with the view of answering the question whether such alterations of flowers can be transmitted. The answer was in the affirmative. The seeds of flowers artificially altered and self-fertilized gave rise to twenty-one seedlings, among which four showed surprising deviations of floral structure. In two of these seedlings all the flowers were greatly altered, and presented some of the modifications of the mother plant,

especially the transformation of stamens into petals. These experiments are still in progress, and it would perhaps be premature to lay too much stress upon them if it were not for the fact that they are so completely confirmatory of the results obtained by similar methods in the animal kingdom.

I submit to you that evidence is forthcoming that external conditions may give rise to inheritable alterations of structure. Not, however, as was once supposed, by producing specific changes in the parental soma, which changes were reflected, so to speak, upon the germ-cells. The new evidence confirms the distinctions drawn by Weismann between somatic and germinal variations. It shows that the former are not inherited, while the latter are; but it indicates that the germ may be caused to vary by the action of external conditions in such a manner as to produce specific changes in the progeny resulting from it. It is no more possible at the present time to connect rationally the action of external conditions on the germ-cells with the specific results produced in the progeny than it is possible to connect cause with effect in the experiments of Herbst and Stockard; but, when we compare these two kinds of experiments, we are no longer able to argue that it is inconceivable that such and such conditions acting on the germ-plasm can produce such and such effects in the next generation of adults. We must accept the evidence that things which appeared inconceivable do in fact happen, and in accepting this we remove a great obstacle from the path of our inquiries, and gain a distinct step in our attempts to discover the laws which determine the production of organic form and structure.

But such experiments as those which I have mentioned only deal with one aspect of the problem. They tell us about external conditions and the effects that they are observed to produce upon the organism. They give us no definite information about the internal changes which, taken together, constitute the response of the organism to external stimuli. As Darwin wrote, there are two factors to be taken into account—the nature of the conditions and the nature of the organism—and the latter is much the more important of the two. More important because the reactions of animals and plants are manifold; but, on the whole, the changes in the conditions are few and small in amount. Morphology has not succeeded in giving us any positive knowledge of the nature of the organism, and in this matter we must turn for guidance to the physiologists, and ask of them how far recent researches have resulted in the discovery of factors competent to account for change of structure. Perhaps the first step in this inquiry is to ask whether there is any evidence of internal chemical changes analogous in their operation to the external physical and chemical changes which we have been dealing with.

There is a great deal of evidence, but it is extremely difficult to bring it to a focus and to show its relevancy to the particular problems that perplex the zoologist. Moreover, the evidence is of so many different kinds, and each kind is so technical and complex, that it would be absurd to attempt to deal with it at the end of an address that has already been drawn out to sufficient length. But

perhaps I may be allowed to allude to one or two generalisations which appear to me to be most suggestive.

We shall all agree that, at the bottom, production and change of form is due to increase or diminution of the activities of groups of cells, and we are aware that in the higher animals change of structure is not altogether a local affair, but carries with it certain consequences in the nature of correlated changes in other parts of the body. If we are to make any progress in the study of morphogeny, we ought to have as exact ideas as possible as to what we mean when we speak of the activities of cells and of correlation. On these subjects physiology supplies us with ideas much more exact than those derived from morphology.

It is, perhaps, too sweeping a generalisation to assert that the life of any given animal is the expression of the sum of the activities of the enzymes contained in it, but it seems well established that the activities of cells are, if not wholly, at all events largely, the result of the actions of the various kinds of enzymes held in combination by their living protoplasm. These enzymes are highly susceptible to the influence of physical and chemical media, and it is because of this susceptibility that the organism responds to changes in the environment, as is clearly illustrated in a particular case by Tower's experiments on the production of colour changes in potato-beetles. Bayliss and Starling have shown that in lower animals, protozoa and sponges, in which no nervous system has been developed, the response of the organism to the environment is effected by purely chemical means. In protozoa, because of their small size, the question of coadaptation of function hardly comes into question; but in sponges, many of which are of large size, the mechanism of coadaptation must also be almost exclusively chemical. Thus we learn that the simplest and, by inference, the phyletically oldest mechanism of reaction and co-ordination is a chemical mechanism. In higher animals the necessity for rapid reaction to external and internal stimuli has led to the development of a central and peripheral nervous system, and as we ascend the scale of organisation, this assumes a greater and greater importance as a co-ordinating bond between the various organs and tissues of the body. But the more primitive chemical bond persists, and is scarcely diminished in importance, but only overshadowed by the more easily recognisable reactions due to the working of the nervous system. In higher animals we may recognise special chemical means whereby chemical coadaptations are established and maintained at a normal level, or under certain circumstances altered. These are the internal secretions produced by sundry organs, whether by typical secretory glands (in which case the internal secretion is something additional and different from the external secretion), or by the so-called ductless glands, such as the thyroid, the thymus, the adrenal bodies, or by organs which cannot strictly be called glands—namely, the ovaries and testes. All these produce chemical substances which, passing into the blood or lymph, are distributed through the system, and have the peculiar property of regulating or exciting the specific functions of other organs. Not, however, of all the organs, for the

different internal secretions are more or less limited and local in their effects: one affecting the activity of this and another the activity of that kind of tissue or organ. Starling proposed the name hormones for the internal secretions, because of their excitatory properties (*ὀρμῶν*, to stir up, to excite).

Hormones have been studied chiefly from the point of view of their stimulating effect on the metabolism of various organs. From the morphologist's point of view, interest chiefly attaches to the possibility of their regulating and promoting the production of form. It might be expected that they should be efficient agents in regulating form, for, if changes in structure are the result of the activities of groups of cells, and the activities of cells are the results of the activities of the enzymes which they contain, and if the activities of the enzymes are regulated by the hormones, it follows that the last-named must be the ultimate agents in the production of form. It is difficult to obtain distinct evidence of this agency, but in some cases at least the evidence is sufficiently clear. I will confine myself to the effects of the hormones produced by the testes and ovaries. These have been proved to be intimately connected with the development of secondary sexual characters—such, for instance, as the characteristic shape and size of the horns of the bull; the comb, wattles, spurs, plumage colour, and spurs in poultry; the swelling on the index finger of the male frog; the shape and size of the abdominal segments of crabs. These are essentially morphological characters, the results of increased local activity of cell-growth and differentiation. As they are attributable to the stimulating effect of the hormone produced by the male organ in each species, they afford at least one good instance of the production of a specific change of form as the result of an internal chemical stimulus. We get here a hint as to the nature of the chemical mechanism which excites and correlates form and function in higher organisms; and, from what has just been said, we perceive that this is the most primitive of all the animal mechanisms. I submit that this is a step towards forming a clear and concrete idea of the inner nature of the organism. There is one point, and that a very important one, upon which we are by no means clear. We do not know how far the hormones themselves are liable to change, whether by the action of external conditions or by the reciprocal action of the activities of the organs to which they are related. It is at least conceivable that agencies which produce chemical disturbances in the circulating fluids may alter the chemical constitution of the hormones, and thus produce far-reaching effects. The pathology of the thyroid gland gives some ground for belief that such changes may be produced by the action of external conditions. But, however this may be, the line of reasoning that we have followed raises the expectation that a chemical bond must exist between the functionally active organs of the body and the germ-cells. For if, in the absence of a specialised nervous system, the only possible regulating and coadapting mechanism is a chemical mechanism, and if the specific activities of a cell are dependent on the enzymes which it holds in combination, the germ-cells of any given animal must be the depository of a stock of

enzymes sufficient to insure the due succession of all its developmental stages as well as of its adult structure and functions. And as the number of blastomeres increases, and the need for co-ordination of form and function arises, before ever the rudiments of a nervous system are differentiated, it is necessary to assume that there is also a stock of appropriate hormones to supply the chemical nexus between the different parts of the embryo. The only alternative is to suppose that they are synthesised as required in the course of development. There are grave objections to this supposition. All the evidence at our disposal goes to show that the potentialities of germ-cells are determined at the close of the maturation divisions. Following the physiological line of argument, it must be allowed that in this connection "potentiality" can mean nothing else than chemical constitution. If we admit this, we admit the validity of the theory advanced by more than one physiologist, that heritable "characters" or "tendencies" must be identified with the enzymes carried in the germ-cells. If this be a true representation of the facts, and if the most fundamental and primitive bond between one part of an organism and another is a chemical bond, it can hardly be the case that germ-cells—which, *inter alia*, are the most primitive, in the sense of being the least differentiated, cells in the body—should be the only cells which are exempt from the chemical influences which go to make up the co-ordinate life of the organism. It would seem, therefore, that there is some theoretical justification for the inheritance of induced modifications, provided that these are of such a kind as to react chemically on the enzymes contained in the germ-cells.

One further idea that suggests itself to me and I have done. Is it possible that different kinds of enzymes exercise an inhibiting influence on one another; that germ-cells are "undifferentiated" because they contain a large number of enzymes, none of which can show their activities in the presence of others, and that what we call "differentiation" consists in the segregation of the different kinds into separate cells, or perhaps, prior to cell-formation, into different parts of the fertilised ovum, giving rise to the phenomenon known to us as prelocalisation? The idea is purely speculative; but, if it could be shown to have any warrant, it would go far to assist us in getting an understanding of the laws of the production of form.

I have been wandering in territories outside my own province, and I shall certainly be told that I have lost my way. But my thesis has been that morphology, if it is to make useful progress, must come out of its reserves and explore new ground. To explore is to tread unknown paths, and one is likely to lose one's way in the unknown. To stay at home in the environment of familiar ideas is no doubt a safe course, but it does not make for advancement. Morphology, I believe, has as great a future before it as it has a past behind it, but it can only realise that future by leaving its old home, with all its comfortable furniture of well-worn rules and methods, and embarking on a journey, the first stages of which will certainly be uncomfortable and the end is far to seek.

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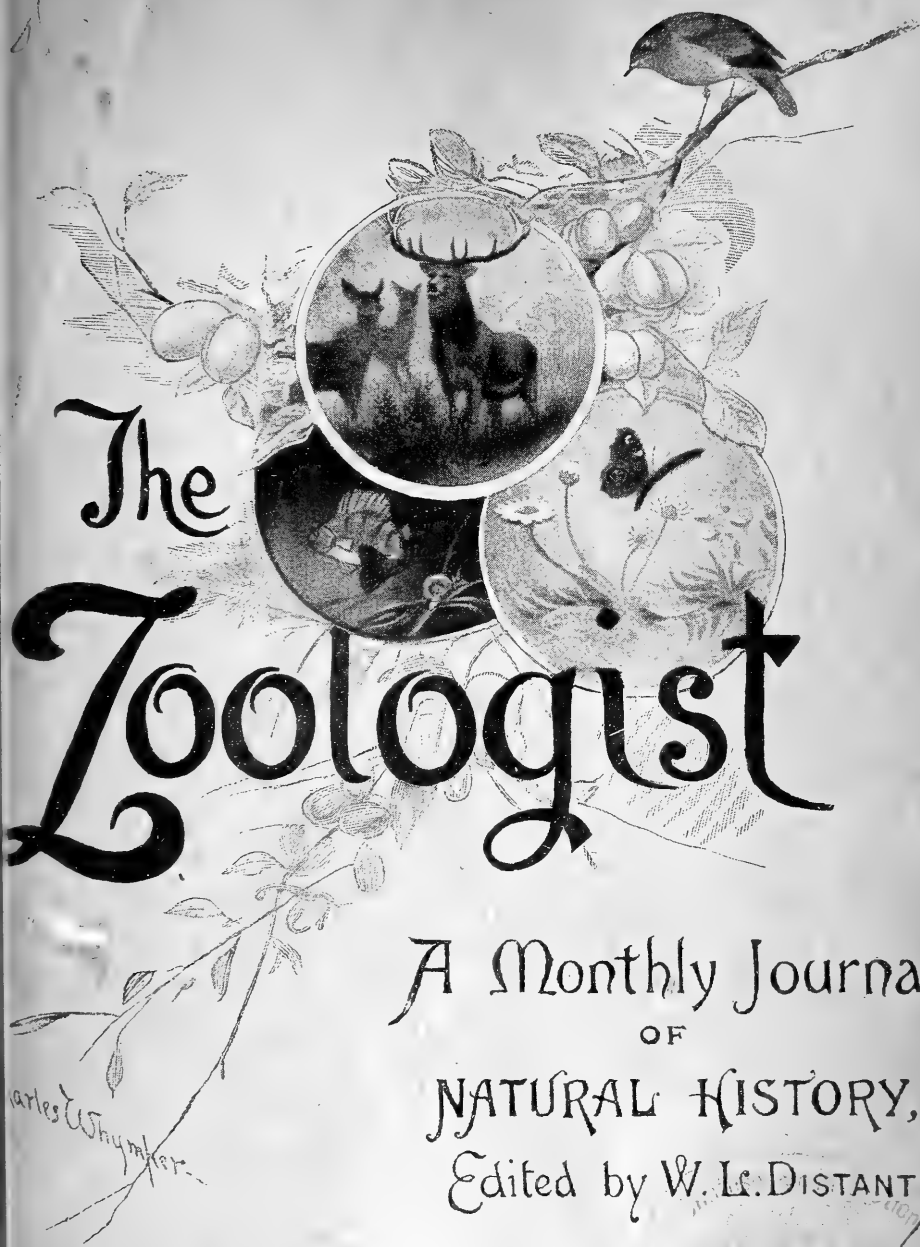
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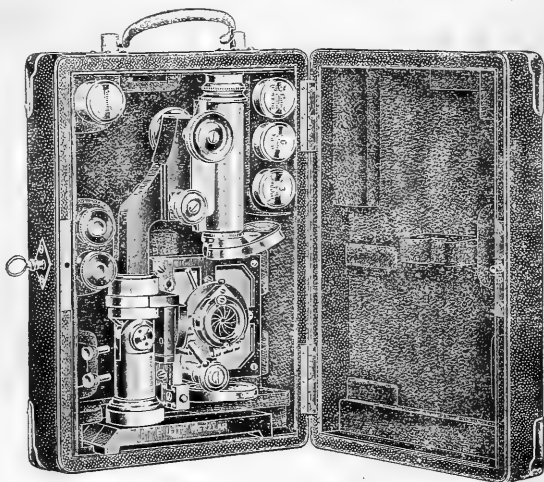
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THE ZOOLOGIST

No. 832.—*October, 1910.*

MENTAL POWERS OF ANIMALS.

BY P. T. L. DODSWORTH, F.Z.S.

To a student of Natural History nothing is perhaps more interesting than to observe the display of mental and other powers by animals. In many instances it is exceedingly difficult to distinguish whether a particular action is the result of instinct, or that of reason, and at the outset it will be as well to understand clearly the difference between instinctive and rational actions. "Instinct," says Romanes, "is a generic term comprising all those faculties of mind which lead to the conscious performance of actions that are adaptive in character, but pursued without necessary knowledge of the relation between the means employed and the ends attained. We must, however, remember that instinctive actions are very commonly tempered with what Pierre Huber calls 'a little dose of judgment or reason.' But although reason may thus in varying degrees be blended with instinct, the distinction between the two is sufficiently precise; for reason, in whatever degree present, only acts upon a definite and often laboriously acquired knowledge of the relation between means and ends. Moreover, adjustive actions due to instinct are similarly performed by all individuals of a species under the stimulus supplied by the same appropriate circumstances, whereas adjustive actions due to reason are variously performed by different individuals. Lastly, instinctive actions are only performed under particular circumstances which have been frequently experienced during the life-

history of the species, whereas rational actions are performed under varied circumstances, and serve to meet novel exigencies which may never before have occurred even in the life-history of the individual."

The chief feature that strikes one in observations of this kind is the extraordinary amount of variability in the mental capacities of animals belonging to the same species. This phenomenon is particularly apparent in dogs. No two are alike, and in individuality they differ as much as human beings do.

For many years past I have been in the habit of attending carefully to various characteristics displayed by dogs and other animals, and by birds, and the result of my observations, as also a few furnished by some friends and others, may, perhaps, be of interest to a few readers.

At present I have two terriers—mother and daughter—and it is astonishing to notice the great mental gulf that separates them. The mother from a very early age exhibited a considerable amount of intelligence, more so than is generally observable in others of the same species. She "took" to rats and guns as a duck does to water, and seemed from the commencement to know what was expected of her. The daughter, on the other hand, had to be trained in both things, and here her instinct did not even seem to help her.

While we are sitting at meals, the old dog frequently scratches one's arms to attract attention when she finds herself being neglected; and again, in order to have her back scratched, she walks up to one, whines, and then turns her head round towards her back to indicate the part of her to which she wishes to draw attention. She has a peculiarity which I have not noticed in other dogs: When she has puppies, and they have grown a few weeks old and are able to crawl about, she finds that her milk is not sufficient to satisfy them, so she has a hearty meal, and deliberately vomits it before them. She then induces the pups to eat by pretending to eat the mess herself, making a low whining noise the while to attract their notice. The mother knows no doubt exactly when meat will not be harmful to her family. I also observed that at this stage she frequently brings bones and other tit-bits for her pups. But

the most interesting example of intelligence is shown by these dogs when they happen to discover a rat or a mouse in a place which they cannot get at without help. I have a very vivid recollection of the behaviour of one of the dogs on the first occasion that she came to me for help. In this case a rat was tracked to a large packing-case, which had been stored away in an empty godown. For a long time I heard a good deal of barking and whining going on, but took no notice of it. The dog, on finding that nobody went to help her, rushed into my room suddenly, and began to behave in a very unusual manner. She repeatedly barked, rushed to the door, and then looked round to see if I was following her. I did not at first grasp what all this meant, and tried to pacify her, but as my efforts proved fruitless, I got up and went after her. She ran on ahead, and kept looking back anxiously to see if I followed. On two or three occasions I stopped, but this seemed to excite her more. Guided by her movements, I came to the box at last, and the cause of the whole of this strange proceeding was, of course, at once apparent. Since then these dogs have frequently repeated this behaviour, and, to tease them, I have pretended to walk in a wrong direction. It is really a most curious sight to watch their efforts to try and set me right!

Among birds, crows are remarkable for their intelligence, and many stories could be related in support of this statement. Large cities, like Calcutta, Bombay, and others in India, generally swarm with the grey-necked variety (*Corvus splendens*), and from seeing how numerous their nests were (I once counted five on a single tree on the Calcutta Maidan), it struck me that these birds must experience considerable difficulty and trouble in getting together materials for their large homes. My attention, however, was shortly afterwards directed by my friend, Mr. Harrington, to their method of obtaining sticks. The procedure was as follows: A crow would select a dry twig, which was still adhering to the branch, and endeavour to snap it with its beak. If it did not readily yield to this force, the bird deliberately flew against it from a slightly higher altitude, and by the force of its momentum invariably severed the twig's connection with the branch. Before the stick had time to reach the ground, other crows, who always seemed to be on the look-

out for such mishaps—the competition for materials being very keen—would fly down after it, and then invariably ensued a struggle for ownership.

I have often wondered whether it is reason or instinct that guides Jungle Crows (*Corvus macrorhynchus*) to the nests and young of small birds. It has been said that some schoolboys have a genius for discovering hidden nests, and all observers in India will agree that crows are in no way behind boys in this respect. These birds are not usually to be seen searching systematically for nests, as an oölogist has to do, and yet the numbers of eggs destroyed by the former is something appalling. They are doubtless to a very large extent guided to the spots by the movements of the parent birds.

Crows apparently know that water has a softening effect, as a couple of years ago I saw one of these birds frequently bring a bone or dry piece of bread, drop it into a bucket containing some water, let it soak for a little while, and then eat it.

A few years ago I was fortunate enough to witness a curious case of intelligence displayed by Short-billed Minivets (*Pericrocotus brevirostris*) when they found that their young were in danger (*vide* 'Journal of Natural History Society,' Bombay, vol. xx., No. 2). A friend and myself were out egg-hunting, and found a nest of this species on a Himalayan cedar. When my man had climbed up the tree close to the nest, the parent birds (as I afterwards discovered them to be) began to behave in a most singular manner. They would turn their tails inwards between their legs, spread out their wings, and flutter down from a neighbouring tree on to the ground, just as a young bird, which could scarcely fly, would do. I at first thought that these birds were the young ones from some other nest which might be close by, and began chasing them about in order to catch them. As soon as I got close to one of them, it would steady itself, and fly on to the branch of a neighbouring tree, only to repeat the performance again. After watching them for some time, and observing them closely, I discovered to my astonishment that they were the parent birds! Their object in behaving in this extraordinary manner apparently was to entice us away from the spot by trying to delude us into

the belief (as they undoubtedly did at first) that they were the young birds from the nest.

My friend, Mr. T. G. Baldwin, has sent me the following very interesting note, which I quote *in extenso* :—

“ You have asked me to give you a few instances which I may have observed of intelligence displayed by animals in the Sundarbans (Bengal), a place with which I have been acquainted for many years. The tract is about 270 miles in length from east to west, approximately 80 miles from north to south, and forms a network of rivers and islands. The main rivers of the Sundarbans are very broad, and near the sea-face the banks are miles apart. The big game to be found in this tract are Royal Bengal tigers, rhinoceri, leopards, and spotted deer ; the common brown monkey is to be seen in great numbers. I may mention that the rhinoceros, unlike that found in Purneah, Assam, Nepal, and other places, has no horn, but there is a growth of very stiff bristly hair where the horn should be.

“ The sagacity of the Sundarban Tiger is very remarkable. Having exploited, we will say, the whole of one of the islands or *churs*, and finding that the deer and pigs have become conscious of its presence, the tiger seeks fresh fields and pastures new to sustain itself. While on this mission, it crosses from one island to another. With apparent ease it will negotiate a small stream in a single leap. But the sagacity of the animal is tested when a broad river comes in the way. If the tiger happens to be north, and wishes to travel in a southerly direction, it proceeds to the water's edge, and enters the stream at a sufficient distance to feel the force of the current. (The rivers are all tidal.) If it finds that the set of the tide is advantageous to its purpose, it starts off, swimming and drifting till it reaches the opposite shore. In one of my visits to the tract, I came upon a solitary island, bounded on all sides by a vast expanse of water. I did not expect to meet ‘stripes’ there, but the fresh pugs on the soft soil clearly indicated its presence. I went in pursuit for some distance, and was only prevented from going further by a stream about fourteen feet wide, through which I did not care to risk wading for fear of being caught in the jaws of a crocodile, which is so abundant in these parts.

“ The ingenuity of the monkeys in this tract is marvellous.

On one occasion a number of them were seen to come to the edge of the stream, which separated them from an adjoining island. The stream was quite twenty feet broad. The alacrity they displayed in devising and carrying out a plan to overcome what appeared to be an unsurmountable obstacle was really wonderful, and is well worth recounting. One of the two largest members of the band firmly attached itself to a bough of a neighbouring tree, and a certain number of the smaller ones linking themselves to it in succession formed, in less time than it takes to relate, a chain. When this preliminary was completed, the other large monkey attached itself to the end of the chain, and, setting it into a swing with its hands, gradually developed a momentum, which enabled it to grasp the bough of a tree on the opposite bank. Those monkeys, including the very young ones, who so far had remained idle on the bank, quickly passed over the living bridge; then, at a peculiar signal, which all seemed to understand, the large monkey, who formed the initial link in the chain, released its grasp, and away they swung safely across to the opposite side of the stream. The calculations of these creatures were, I should say, as accurate as if they had been determined by mathematics. They gauged the breadth of the stream, and the exact number of them which it would take to form a chain of sufficient length to stretch across. This incident occurred at a river called the Booj Booja, at a bend known as 'Fiddler's Elbow.' What I have never been able to ascertain is how these creatures manage to cross the broad rivers. They certainly could never swim such distances; I fancy they must get hold of some floating tree or palm, and so drift until it touches a bank, and then disembark.

"While in quest of rhino, it is interesting to note how the *shikaris* can indicate where the animals are to be found in the jungles. One would think that these large, unwieldy creatures would not be difficult to come up with when once their footprints were found. But this is not the case. You may come up with them in time, but owing to the very dense forest you will probably pass them at a distance of 100 or 150 yards. The *shikaris* are really the only persons who can locate them without difficulty. They ignore the footprints, but every now and again you will observe them halt and look up at the tops of the trees.

On my inquiring of one the reason for this action, he replied :— ‘The *gandar* [native name for rhino] always likes the young leaves of the *garran*.’ (This tree is used largely in Calcutta for fuel, and is *slender*, and does not generally grow to a great height.) Asked : ‘But how do they get to the top leaves?’ ‘Very easily, sir,’ replied the *shikari*. ‘They take it by turns to eat. One of them leans his huge body against the stem ; the soil being soft the tree bends with its weight. If yet too high for the young leaves to be got at by the others, the animal moves his body higher up the trunk of the tree.’ ‘But, then, would not the tree lie where it had been pressed down?’ ‘Temporarily it does,’ replied the *shikari*, ‘but after a time the weight of its roots brings it to an upright position again, and that is why you see us always looking up at the tops of the trees to see whether they have been nibbled at and broken off.’

“These animals are now very scarce ; a great number of them were destroyed in the cyclone of 1867. They are with difficulty to be had except away up to the north. Prior to the cyclone they were very numerous at the mouths of the Roy-mangal and Molinchoo Rivers.”

My brother, Mr. Owen Dodsworth, of the Indian Forest Department, was stationed for some time in the Sundarbans, and informs me that the tigers in this tract know well the difference between the ordinary boats and “dingies” (dug-out canoes). The latter are used by the wood-cutters, and while some were about to land on one occasion in the forest a tiger sprang into the dug-out, caught a man, and sprang back again to land with him. Had these men used an ordinary boat it is probable that the animal would not have molested them.

Birds sometimes show considerable intelligence in availing themselves, during the breeding season, of the protection afforded them by the more quarrelsome and powerful species. This is notoriously the case with the larger Falcons, and “their fellow-tenants of a rock or a tree are not only safe from molestation, but actually look to them for protection.” Some of the *Dicruri* are exceedingly pugnacious during the breeding season, and never allow crows, kites, *et hoc genus omne*, ever to approach within their “spheres of influence.” It is, therefore, not an uncommon thing to find nests of the weaker species in close

proximity to those of Drongos. Along this portion of the Himalayas (Simla) the eggs and young of the Kokla Green Pigeons (*Sphenocercus sphenurus*) suffer largely from the depredations of Jungle Crows, and I have often found a nest of the former placed within a few feet of one belonging to the Indian Ashy Drongo (*Dicrurus longicaudatus*). The Koklas belonging to the nest were allowed free access and regress to the tree, but it was very different when a stranger showed himself in the vicinity. In this particular instance that I happened to witness, it was an unfortunate Black-throated Jay (*Garrulus lanceolatus*), which unknowingly approached too close, and was handled so severely by the Drongos that it soon had to make itself scarce.

Vultures are dull birds, and yet I have been assured on excellent authority that on one occasion when a zealous oölogist approached the nest of apparently a *Gyps bengalensis*, the old bird refused to budge, and, to get rid of the intruder, vomited on him! The sequel of the story is not known, but we may, I think, safely assume that the old bird was left in peaceful possession of her home.

One cannot help being struck with the extraordinary care and judgment exhibited by a large majority of birds in the selection of sites for their nests. When the proper time approaches, a pair may frequently be seen examining branch after branch with the minutest scrutiny; the examination sometimes extending over a considerable period, and at other times being only the work of a few hours. In a large number of cases, it is not easy to say why a particular spot has been chosen, when scores of other places, which to our way of thinking are equally as good, have been rejected. Ants, lizards, exposure to rain and wind, food supplies, &c., are no doubt important factors, which must necessarily be taken into calculation, though these do not always appear to influence selection. Concealment from possible enemies is of course the *sine qua non* aimed at, but even this important precaution is not always taken. Some nests are placed in exposed positions, and the only reasonable conclusion to be drawn is that in their very conspicuousness lies their safety.

Once a spot has been selected, building operations go on with great activity; but in some instances, when a nest has

been partially completed, the site is, for some reason or another, found insecure, and a fresh one chosen; the materials from the old nest being utilized freely for the new one. I have known of an instance in which a pair of birds shifted their nest three times in quick succession to various parts of a bush, but could not ascertain the reason of this. I examined the rejected sites most minutely with a powerful magnifying-glass, but not an insect of any kind was visible, and the rejected sites appeared to be better sheltered from rain and wind than the one chosen last. There must, however, have been some defect, and, in justice to the wisdom of the birds, I must add that they successfully reared their young.

The cleaning of the nests by most Passerine birds is purely an instinctive action; but to realize fully the dangers which would ensue from insanitary conditions, if the excreta of the young were not carried away by the parent birds, one has only to keep, for a few hours, a nest full of young Tits or Magpies. In some species both parents help in cleaning the nest; while in others I have noticed that this task is relegated only to the hen. Of course the pains taken by the old birds to drop the excreta as far away as possible from the nest have the obvious object of concealing all traces of their young from likely enemies.

Faint traces of what may be called *forethought* are sometimes noticeable in dogs and birds. One of my terriers, when not hungry, has a habit of concealing bones in holes in the ground, and then covering them over with some mud. Whether she ever remembers these places afterwards, when necessity arises, and brings out the hidden treasures, I have been unable to ascertain.

Various species of Magpies in confinement also exhibit this habit of hiding scraps of food in nooks and corners of their cages.

We have often heard of dogs, which have been brought up with cats, *imitating* the latter in some of their habits; but at present I have a dog which has never in all her life been privileged to associate with any members of the cat species, and yet some of its actions are distinctly feline in character. For instance, it has a habit of playing with a wounded bird, or half-dead mouse, just as a cat does. And again, it licks its paws, and frequently sits with its front legs bent inwards. When

stalking after Squirrels or Sparrows feeding on the ground, its actions and movements are very similar to those of a cat.

Some years ago I had a pair of Jackals (*C. aureus*), which were brought up with the dogs of the house, and the former in various ways learnt to imitate the latter. They would rush out of the house after strangers just in the manner of dogs; hunt in company with them; and once actually helped to kill a wild cat! They would often come to the table for scraps, but never got rid of that horrible habit of howling when they heard their brethren outside.

Lovers of dogs should be able to throw some light on the question whether the canine species ever suffers from the effects of *somnambulism*. Some years ago I had a dog which would often, while fast asleep, suddenly jump down from his bed, walk about the room in a dazed sort of manner with half-closed eyes, and quietly get back to bed again as if nothing unusual had happened. During these midnight wanderings, I once or twice made a noise by dropping a book on the floor, or clapping my hands, and the dog certainly seemed to wake up and stare about, just as a human being might be expected to do, if roused suddenly out of a deep slumber.

I have frequently noticed that dogs, when *dreaming*, not only bark in low tones, but keep moving their jaws as if they were crunching something. A few twitches in the hind legs are sometimes also noticeable.

Birds seldom appear to dream, but when they do, I have occasionally noticed them opening and shutting their beaks. Doves and pigeons frequently "coo" in the nights, but I have never yet been able to ascertain properly whether they were awake or dreaming.

Animals and birds are, without doubt, fully cognisant of the great principle that "in unity lies strength." Most of us have doubtless often observed that a dog, when single-handed, will sometimes refuse to attack a wild cat, or other similar animal, and yet how completely matters change if another dog is introduced on the scene.

In this station (Simla) there seems to be an old standing feud between the monkeys and crows, and when the latter are breeding, the former make a great point of destroying as many

eggs and young as they possibly can every year. When these marauding excursions take place, two monkeys invariably take the field, and while one keeps the crows employed, the other slips off to the nest and quietly drops the contents on the ground.

In the case of the ordinary House-sparrow (*Passer domesticus*) I have frequently noticed that, not content with installing himself in a particular neighbourhood, and bringing up innumerable families in quick succession, he forthwith proceeds to install others of his fraternity in the same place, and when once established, they jointly set to work and systematically drive away all the other small birds from the vicinity. "Live and let live" is a maxim quite foreign to the sparrow's constitution, as every oölogist knows. I have notes of several cases which have come under observation of sparrows—not singly, but invariably in numbers—having systematically bullied and driven away small birds which intended nesting in the compound. A few years ago a pair of Crested Black Tits (*Lophophanes melanolophus*) decided to set up their home in one of the numerous crevices of an old outhouse attached to my bungalow. I had never seen a nest of this species before, and was, therefore, very interested in their proceedings. The spot chosen was in a very convenient situation for making observations, and for several days I spent a large portion of my time in watching the progress of the building operations. Some House-sparrows were also nesting close by, and complete harmony seemingly prevailed among all tenants. The tits' nest was nearing completion, when suddenly the sparrows began to show signs of prying into their neighbours' affairs, and would make several attempts to peep into the nest. The peaceful tits seemed disposed to ignore these intrusions, but the inquisitive attitude of their neighbours soon developed into a more aggressive one. From peeps it came to blows, and as soon as an unfortunate tit showed itself on the scene, it was immediately chased away. After making several attempts to regain the position, they eventually deserted the nest, and shortly afterwards I saw a pair of sparrows installed in peaceful possession! Superfluous to add that they had forthwith to pay the extreme penalty of the law.

Take again the case of the common Red-headed Tits (*Ægi-*

thaliscus erythrocephalus), which invariably associate in small parties, and as explained by Professor Newton, "it requires no very abstruse reflection to perceive that the adoption of this habit is one eminently conducive to the easy attainment of their food, which is collected, as it were, into particular spots often far apart, but where it does occur, occurring plentifully. Thus a single titmouse searching alone might hunt for a whole day without meeting with a sufficiency, while if a dozen are united by the same motive it is hardly possible for the place in which the food is lodged to escape their detection, and when discovered a few call-notes from the lucky finder are enough to assemble the whole company to share the feast. It is impossible to watch a band of any species of titmouse, even for a few minutes, without arriving at this conclusion. One tree after another is visited by the active little rovers, and its branches examined; if nothing be forthcoming away goes the explorer to the next that presents itself, merely giving utterance to the usual twitter that serves to keep the body together. But if the object of search be found, another kind of chirp is emitted, and the next moment the several members of the band are flitting in succession to the tree and eagerly engaged with the spoil."

The following is an extract from my daily journal, and relates to an account of an attack made by Red-billed Blue Magpies (*Urocissa occipitalis*) on my climber:—

Keonthal State (Punjab), May 5th.—So far as I am aware these birds never breed in company, and the large number of nests so close to each other struck me as most peculiar; the more so, as up to this we had only seen a couple of these birds in the neighbourhood. . . . However, each nest was examined in turn, but it was very different when the climber approached the tenanted one. The whole hillside seemed suddenly to get alive with these birds, and eight or nine of them appeared most miraculously on the scene. Uttering their harsh cries, they began making most furious dashes and pecks at the climber, quite regardless of their safety. So determined did their attacks become that at one time I thought we had lost the field. The nearer the man approached the nest, the bolder did the birds become. And their tactics were truly worthy of a Hannibal. At one time forming into separate parties, and attacking both

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from front and rear; now singly, now in a body, now on all sides. All the climber could do was to get down with a whole skin, and in spite of coaxings, threats, &c., nothing would induce him to attempt the nest a second time. It was only after I very reluctantly shot one of the plucky little fellows, and drove away the rest, that we were able to examine the nest in safety. . . . It was one of the most interesting sights that I have ever witnessed in my life. And here, what is still more interesting to an ornithologist is that, not only did the birds belonging to the nest take part in its defence, but all the others of the same species in the neighbourhood also joined in it.

That some animals and a few birds occasionally indulge in *practical jokes* will, I think, be readily admitted. Take the case of a dog which has been trained to bring balls or pieces of sticks which are thrown in front of it. It will sometimes bring the object and drop it in front of one, and just as its master goes to pick it up, it will seize it, and run off with it.

A few years ago I had a small poodle, which was in the habit of chasing and barking at monkeys. One day I saw a large monkey catch it in his hands, give it a good shaking, and then let it go. And again, I once saw a dog slapped in the face by one of these animals.

Last year I happened to witness an amusing incident in the "Eden Gardens" in Calcutta. A large number of Flying Foxes (*Pteropus edwardsii*) had taken up their abode on one of the high trees growing on the sides of one of the avenues, and the crows (*C. splendens*) spent a good deal of their time daily in harassing these poor animals. A crow would take up a position on a branch from which a few foxes were suspended, look at them in a most casual sort of way as if no harm were intended, and having selected an unfortunate, who was half asleep, peck at him most viciously three or four times in quick succession. When he had roused all the foxes on the branch to his complete satisfaction, he would suddenly dart across to another branch, from which a few more of these animals were suspended, and while passing, make a sudden assault on one, who was probably in dreamland, and was thus always taken unawares. Judging from the number of crows taking part in this game, it seemed that they derived much

enjoyment from this form of recreation. The Flying Foxes doubtless had a very different opinion !

In the way of *recreation*, I have often noticed the Simla Crows (*C. machrorhynchus*) sailing about in wide circles high up in the air, and occasionally in the evenings indulging in a game which looks very like "I'm the King of the castle" on the lightning conductors of the Imperial Secretariat Buildings.

The common Kites (*Milvus govinda*), especially the young birds, may often be seen playing with each other in the air. One bird gets above the other, and then makes a swoop downwards, and is received by the lower one, which turns on its back with its talons upwards, and so on, till both are lost in the azure of the sky.

The only case of *abnormal* instinct which has come under my observation is that of one of my terrier bitches bringing up a pup which had lost its mother. Before the pup was brought into the house, the bitch showed no signs whatever which would lead one to suppose that she would shortly become a mother, and yet, after allowing the pup to suckle her, in a few days she developed a copious supply of milk in all her teats.

One of the most curious cases of *aberrant* instinct which I have read about is that mentioned in Col. G. Marshall's 'Birds' Nesting in India' (Calcutta, 1877), on the authority of Col. Tucker, R.E., the heroine this time being a Kite (*Milvus govinda*):—"Kites are not attractive birds, except for the wonderful grace of their flight, and it is hard to imagine a tender heart beneath their fierce but treacherous and withal cowardly exteriors. In the month of January, in Lower Bengal, when with the kites the breeding season is at its height, a solitary female, over whom the instincts of the season evidently had their sway, but who from some cause or other was unprovided with a nest or eggs, appropriated an empty pill-box that had been thrown on to the roof of a portico, and gathering some sticks and straws round it in the corner of the roof to serve as a nest, she commenced and carried on with admirable perseverance a forlorn attempt to hatch it. When approached and driven from her place, she would return to defend the beloved treasure, dashing fiercely at the intruder. How long it would have taken before her hopes of welcoming a young kite out of the pill-box

would have been finally abandoned was not proved, for a heavy storm of rain reduced it to a pulp, and in its place the egg of a domestic fowl was put down, and on that the kite, now joined by a male kite, who keeps careful guard over her, is still sitting. The egg will be hatched in a few days, and the life of the young chick, which will probably be short and adventurous, will commence."

A well-authenticated case of a dog acting as foster-mother to a very young kitten has been kindly contributed to me by a friend. The dog, a black-and-tan terrier, had a batch of pups, which were given away after they were a fortnight or three weeks



old. Very shortly after this a tabby kitten was found in the street by the gentleman's children, who brought the little thing home, and put it to the terrier's teats, which had become enlarged and swollen in consequence of a copious supply of milk. The kitten, being in a starved condition, readily took to its foster-mother, but the bitch at first resented the action. She seemed, however, to appreciate the relief, but would not allow the kitten to suck too long. Gradually she became accustomed to it, and when her teats got full of milk she used to hunt up the kitten and give her a feed. The illustration shows the foster-mother feeding the kitten when about two months old. The kitten grew up to full size, and used to join its foster-mother in her chases after other cats!

Dogs and a few other animals, when rebuked, undoubtedly

feel *shame* ; and the germs of this idea appear to some extent to exist in birds. All observers will admit that crows are seldom, if ever, seen *in copula*, and when a pair dare to carry their matrimonial endearments too far, the rest, as if aware of their comrades' indecent behaviour, invariably make it a duty of immediately putting an end to all such public displays of affection.

"As for the wing-drooping, tail-cocking strut," says Finn, "which the English rook indulges in during the breeding season, any Calcutta crow who presumed to show off in such a way would most likely be very soon taught that it was no 'matter for his swellings, nor his turkey-cocks.' This interference by crows in each other's domestic affairs is not confined to their own community, but is extended to other birds which might happen to misbehave themselves publicly. I have frequently noticed in Calcutta that the crows invariably made it 'a point of honour' of trying to stop the amorous displays on the part of kites, which are notorious sinners in publishing their banns of marriage *more felino*."

IMPRESSIONS OF A NATURALIST ON THE WHITE RIVER, TRANSVAAL.

BY A. T. COOKE.

Footprints.—Rising in the neighbourhood of that famous landmark of the Eastern Transvaal, the prominent Spitz Kop—a landmark which has guided so many transport-riders from the coast at Delagoa Bay to the interior—the White River pursues its way through an uninteresting, bushless country until it reaches the White River Falls, where, tumbling in a double cascade, 150 ft. in height, over huge rocks fringed with tropical trees of every hue, it then becomes a series of foaming rapids and deep pools, leaping and spraying as if rejoicing that it has at length reached a mountainous and forest-covered country.

These falls are on the borders of my farm, and the last six miles form one boundary. I love my river, every yard of it, the rapids and the deep pools framed in a glistening white edge of sand, and it is of this river I write, for along its banks I love to wander—to trace the footprints of the lovely Antelopes, where in the night time they come to the water's edge to quench their thirst. Here are the sharp-pointed Duiker* and Steenbok† prints as they seem to stroll alongside the water; the more business-like marks of the Bushbuck,‡ who seems to come straight to the water's edge, doubtless turning anxious and alert glances every way ere it lowers its stately head to drink, and even then it has to watch the water, for one cruel snap from that "lurking death" beneath, when its strength would little avail against the tremendous pulling power of the Crocodile. But here the owner of the footprints encountered no ill, straight down from the bush were its tracks, the two fore feet close together as it drank, and then straight back to the bush again. In the maze of footprints, distinct and clear, can be noted what I have ever

* *Cephalophus grimmii*.

† *Raphicerus campestris*.

‡ *Tragelaphus scriptus* var. *sylvaticus*.

called the lazy Reedbuck,* perhaps conscious that its title of Royal game protects it from the great destroyer man. Then there are the stealthy trails of the Antelope's enemies, the claw-like marks of the Crocodile, the scaly imprint of its body as it rests awhile, and the Serpent-like impression of its long tail dragged behind. But what is this distinct footprint? An appeal to the native (who views my great interest in what to him is so commonplace with the contempt he has for most of white man's ways) brings the indifferent answer, "Ingwe, Baas." So this is a Leopard† after its prey. I follow those marks for some distance—here wide apart—and in fancy could imagine that cat-like head lowered searching, advancing and then it stops—perhaps to scratch itself or silently standing still to listen to some sound that had stirred the stillness of the night—while a little further on a narrow strip of water to be crossed entailed but a gentle spring, for it could be clearly seen that it had no wish to wet its paws. I follow on until a bed of reeds bury from my view any further sign and caution compels me to climb up the rocky banks. I saw ahead that the Leopard had continued its nightly stroll beyond, until, pining for change, it must have turned sharply into the bush, where fancy must leave it, but wondering whether it caused the night echoes to be awakened by the frightened scream which is the prelude to its every meal.

The Water-Tortoises in their evening stroll leave quaint parallel rows as curious as their course in aimless twistings in and out, as if this their lighter element of air did make them irresponsible as to their ways—perhaps due to the light-heartedness of happiness, for out here on the sand they can have little fear of enemies. Of a dark brown colour, entirely encased in a coat of armour as hard above as it is beneath, and that curious hinged door completely covering the opening whence it withdraws its head on alarm. Surely it is safe! but far from it. The vice-like jaws of the Crocodile close upon it, crush and splinter its armour in fragments. Ejected, its body must appear but a Shrimp-like morsel; surely not tasty, for it has the power of emitting upon capture the most disagreeable of odours, and the angler who finds he has unwittingly caught a Tortoise on his hook is only too glad to wrench it out,

* *Cervicapra arundinum*.† *Felis pardus*.

preferably with his boot, and to kick the Tortoise hastily back to that element from which it should never emerge. Does he in his nightly prowl ever encounter his brother of the rocks, the Rock-Tortoise, and do they both share the same capacity of abstaining from food for an incredible period?

The stroll is ended, the White River discharges its burden and the sorrows of its tragedies into the broader, deeper Crocodile River, where nature continues the cruel war—those shuddering reptiles with the iron jaws ever awaiting their prey. Only very recently, some miles below, a traveller, resting from the glaring heat of the tropical sun, observed a Crocodile on a rock, in appearance an excrescence of the rock as it lay basking in the fierce sunlight and still air, apparently asleep. It would have been well had it slept, for two stately Impala Antelopes* step silently from the bordering bush to the water's edge, and as a cautious glance around gives promise of safety, the ram enters the water. Before he has reached the other side the enemy silently slips off its rock,—making no noise, only a swirl upon the water,—and this is quickly seen by the swimming Antelope, which seeks, at desperate redoubled speed, to gain the safety of the shore, which he reached. Scarce had his feet left the water when out rushed the protruding and repulsive head of the Crocodile, and as quickly withdrawn—too late, baffled. Surely some cry would be given by the one who so narrowly escaped to his mate waiting on the other bank; but the gazer saw the doe slowly enter and begin to swim across. Anxiously her course was watched, and the reaching of well-nigh the centre of the river gave hope, but then, without warning, without a cry, high up out of the water sprang the head, shoulders and fore legs, and as silently the doomed animal disappeared beneath the waters; just a circling swirl, closing like a pall, the little ripples ever-widening reaching to the bank as if conveying one more message, one more warning of the tragedy and danger of the water to those that dwell upon the land.

* *Aepyceros melampus*.

THE EGRET IN BRITAIN.

BY FREDERICK J. STUBBS.

I SHOULD like to present a little more evidence bearing on the question of the presence of an Egret in Britain in olden times (*cf.* 'Zoologist,' *ante*, p. 150). There need be no further doubt as to the actual breeding of the bird, for I find it mentioned in a most interesting "Act for the Preservation of Grain," passed in 1564 (8 Eliz. c. 15). This Act, itself only temporary, revived portions of an earlier one of 1533, that was only in operation for ten years; and both were aimed at the "innumerable nombre of Rookes Crowes and Choughes" [Jackdaws] that "do daily brede and increase throughout this Realme, which Rookes Crowes and Choughes do yearly destroye devoure and consume a wonderfull and mervellous greate quantitie of corne and greyne," &c. These two Acts command, under penalties, the organized destruction of Rooks and Crows especially, and are interesting as marking the probable origin of the pastime of Rook shooting.

The 1564 Act ordered the destruction of many other creatures besides Crows, and directed how their slayers were to be rewarded. "For every head of Martyn Hawk,* Fursekytte, Moldkytte, Buzzard, Schagg, or Ringtail 2d., and for every two of their eggs 1d. . . . For every head of Iron [Sea Eagle] or Ospraye 4d.; for the head of . . . Kingsfisher; . . . Bullfinch or other bird that devoureth the blowth of fruit 1d." "Kingsfisher," it is worth noticing, is still in use in parts of the north of England.

The Fox, Gray [Badger], Polecat, Wesell, Stote, Fayre bad or wild Catte [?], Otter, Hedgehogges,† Woodwall [Green Woodpecker], Stare, and many others were all game for this parish

* Hen Harrier, 'Oiseau St. Martin,' Buffon, i. p. 212.

† Singular number? *cf.* "3 hedge hodgs, 1s. 0d." Accounts of Rochdale Parish Church, 1643.

net; but the Act did not allow the killing of Kite or Raven in or within two miles of any city or town corporate, and care is taken to point out "that this Acte . . . shall not give liberty to any person . . . to use any meane or engyn for the destruction of any Crowes Rookes Chawghes or other vermin to the Disturbance Lett or Destruccon of the building or breeding of any kinde of Hawkes, Herons, Egrytes, Paupers, Swannes, or Shovelers, or to the hurte or destruction of any Doves or Dove-houses, Deere, or Warren of Conyes." Stares were not allowed to be taken from Dove-houses, but could be caught elsewhere.

Here we get definite proof that in 1564 there was an "Egryte" worthy of special protection as a game bird in this country, at a time when it was under repeated notice in contemporary literature as a bird of the Heron kind. It is hardly likely that either the bird or the Act escaped the notice of Francis Willughby; but it must not be forgotten that his work was finished and published by another hand in 1576, four years after his death; and this may be some explanation of the lack of any more definite mention of the Egret in his 'Ornithology,' although it hardly explains the silence of other writers.

To my mind a passage in Sir John Hawkin's account of Florida ("Hakluyt Soc." 1878, p. 62) is very important. He describes an "Egripte" (the same spelling as that used in Alde's 1590 edition of the 'Booke of Kervynge'), "which is all white as the swanne, with legs like to an hearnshaw, and of bigness accordingly, but it hath in her taile feathers of so fine a plume, that it passeth the estridge his feather." Surely this can only imply that the Egret with which he and his readers were best acquainted was not white, nor the size of a Heron, nor adorned with plumes. Yet, according to some contemporary writers, as I indicated in my first paper, this British Egret was white, while Turner stated definitely that the white nested with the blue and produced offspring; and, also, he detected slight but distinct points of difference between the British bird and the Italian *Albardeola*.

Have we here a hint of the phenomenon of dichromatism in this extinct bird? All modern students of ornithology will be familiar with the extraordinary variations found in certain

species of North American Egrets (Stejneger, 'Stand. N. H.,' iv. pp. 6-8; Sharpe, 'Cat. B. B. M.,' xxvi. p. 106, &c.). In *Dichromanessa rufa* there are two distinct phases, one normally grey and the other pure white—not, it must be remembered, merely pathological albinos; and it is only during recent years that these two forms have ceased to be placed in different species and even genera. I shall return to this question shortly.

William Harrison, best known for his authorship of a 'Description of England' appended to Holinshed's 'Chronicles,' has a little to say about the wild life of his period (Book 3, c. 2, 1587 edition), and offers a list of the birds then breeding in this country. He specifies, amongst many others, Crane, Bittern, Wild and Tame Swan, Bustard, Doterell, Brant, Barnacle (which he believed came from a shell), Wigeon, Olet [Oystercatcher], . . . "besides divers others whose names are to me utterly unknown, and much more the taste of their flesh, wherewith I was never acquainted." He adds: ". . . as for Egrets, Pawpers, and such like, they are dailie brought unto us from beyond the sea, as if all the foule of our own countrie would not suffice to satisfie our delicate appetites." It is clear that these birds simply augmented the home supplies, and did not constitute them, for the first edition of Harrison's book was published in 1577, only thirteen years after the Egret was expressly protected in England. Where did our author get his information? The rest of his book is obviously compiled from works that are still extant, and all his items read familiarly to the student of mediæval literature; but perhaps this fragment on the importation of the Egret is of his own personal knowledge, and so may not be found in other works. As I have already shown, Egrets were killed by the cook, and their blood was saved for the making of sauce. Therefore, we must assume that these imported birds were brought to England alive—indeed, with the methods of transport at the disposal of the times they could hardly have been carried dead and fresh for any distance. Where did these foreign Egrets come from? Southern Europe can be left out of consideration altogether; and so it is likely that this lost bird lived in some other Northern European country besides England. It seems to have enjoyed a long reputation as a table bird, for in the time of Edward I. it headed the list of game birds with the

unusually high price of eighteenpence (Phipson, 'Animal Lore in Shakespeare's Time'). We know that from century to century the bird population of these islands fluctuated very much, and this high price may not always have been attached to the species.

In again leaving the subject I may summarize our knowledge as follows:—At the middle of the sixteenth century England was the home of an Egret that was highly esteemed for the table. It nested with us, and was protected by law; and the same, or an allied species, inhabited an adjacent part of the Continent, and was brought to this country alive for food. *Probably* the bird was not altogether white, but exhibited two distinct phases of colour, thus differing from any existing European Egrets or Herons, and resembling species now found in America.

The position is still rather tantalizing, but I am sanguine that in time the whole matter will be cleared up. The reckless destruction of British wildfowl has for centuries been a matter of common protest, both in Scotland and England (*cf.* particularly Jac. ii. c. 31 (1457); Mary (1551) c. 2, c. 15; Jac. vi. (1600) c. 34; Jac. vii. (1685) c. 24). By certain Scots laws the penalties for illegally killing wild birds were astonishingly heavy—because of the "slaknes of the execution of former acts." "Heronis . . . thair nestis eggis or birdis" were mentioned repeatedly, but I can find no evidence for the existence of an Egret north of the Border. The Scot was just as eager as the Englishman to get rid of his "crawys and other foulis of rief."

ON THE YAWNING OF FISHES AND OF OTHER VERTEBRATES.

BY ALFRED HENEAGE COCKS.

MR. RICHARD ELMHIRST's observations (*ante*, p. 321) "On the Yawning of Fishes" and of other Vertebrates, though very interesting, are surely not a new discovery. It is now fully forty-six years since I set up some small fresh-water aquaria, wherein in the course of time a considerable number of fish were under observation, representative of about two dozen species, and I have not infrequently seen fish yawn, but made no notes as to which species were seen to do so, because it never occurred to me until now, on reading Mr. Elmhirst's remarks, that this action was otherwise than a well-known habit common to most, if not all, vertebrates.

My conviction is that all the two dozen or so species did this, except perhaps Lamperns and Fringe-lipped Lamperns. I have elsewhere seen various species of sea-fish yawn. For several years previous to starting aquaria I must have been aware that at least a few of the more familiar domestic mammals yawn. During the years that have since passed I have seen so many vertebrates of all classes and of so many orders yawn that I cannot doubt that it is a general, even a universal, habit, and there must be numbers of observers who have watched animals in captivity, in the London and other zoological gardens, who can easily cap my very imperfect recollections. It is natural to suppose that animals in captivity (even in comparatively roomy quarters) would yawn more frequently than those at liberty, and at any rate one has with the former a better chance of observing the act.

With regard to Birds, I venture to generalize, and to declare my belief that there is no exception to the axiom that all birds yawn. I know that many Reptiles and Batrachians yawn, and it seems unlikely that there are any exceptions among these classes also.

While expecting that more perfect knowledge would show that yawning is also universal among Mammals, I cannot recollect ever having seen Cetaceans of any kind yawning when at the surface of the sea, but that is no proof that they do not do so; and is it physiologically impossible for mammals, however thoroughly specialized for an aquatic life, to perform this action under water? Some species of Cetaceans (and most likely all) certainly appear to sleep under water more often than on the surface. The Great Ant-eater would seem the most likely of all mammals to be an exception to the general rule, but it would be safer to assume that even it can yawn until the contrary is proved; and the same may be said as to the *Petromyzontidæ* among Fishes.

Of the mammals as to which Mr. Elmhirst expresses doubt, Horses very commonly yawn (one of my farm-horses always yawns directly he finds that he is being "shut out," *i. e.* released, from the cart, plough, or other implement that he has been dragging or assisting to drag); Asses, Cattle, Sheep, and Pigs also yawn. Goats I cannot answer for, but there is not the slightest reason why they should be exceptional. Among rodents, as to which order Mr. Elmhirst can find no record, domesticated Rabbits and Guinea-pigs yawn at any rate, and I do not doubt that I have seen other rodents do so also.

Of the few species of wild mammals with which I am specially familiar, most are certainly yawners; it seems unnecessary to give a list, and I submit, with all deference, that it is superfluous to publish a catalogue of the vertebrates that are seen to yawn, but rather that any species (or family) should be noted which, after having been kept under careful observation, has never been detected doing so.

BIBLIOGRAPHY OF LONDON BIRDS.

SUPPLEMENTARY TO LIST IN 'THE ZOOLOGIST,' 1909, PP. 15-16.

BY HUGH BOYD WATT.

THE under-noted items of literature are additions to the above-mentioned list, and fulfil the anticipation of amplification expressed when it was published.

The area covered has been somewhat extended, but none of the localities included has any less claim to be considered London than has Richmond, which found admission into the first list. If any further justification of this extension is required, it may be found in the likelihood that in a few years all these districts are likely to be engirt by Greater London.

It should be stated that the naturalist columns of 'The Field' have not been gone through. So many valuable and original observations and notes on the topic are to be found there that a subject-index would be necessary to do them justice and make them adequately available. Neither have newspapers been drawn upon, although original and informing contributions are not unknown, such as the excellent article on "Wild Birds in London" in the 'Times' of March 27th, 1909; nor works like Mrs. Evelyn Cecil's 'London Parks and Gardens' (1907), where the information about birds is from other sources.

Mr. J. E. Harting has kindly read my list, and I am much indebted to him for suggestions and information.

LIST UNDER AUTHORS.

1. AKERMAN, J. Y.: "The Birds of London." 'The Zoologist,' xiii. pp. 4702-3. London, 1855. A few species noted in Central London.

2. ALDRIDGE, W.: 'A Gossip on the Birds of Norwood and the Crystal Palace District, with thirteen full-page woodcuts.' 8vo. Upper Norwood, 1885.

3. BLYTH, E.: "On the Species of Birds observed during the last four years in the vicinity of Tooting, Surrey." 'London's

Mag. Nat. Hist., ix. pp. 622-38. London, 1836. List of ninety-seven species with many personal observations.

4. BLYTH, E.: "Observations on the Wild Fowl in St. James's Park." 'London's Mag. Nat. Hist.,' xii. pp. 469-71. London, 1839.

5. CHIPPERFIELD, H.: "Birds of North-east London." 'Nature Notes,' xi. pp. 70-4. Selborne Society, London, 1900. Stoke Newington by Stamford Hill and Lea Marshes to Stratford. Historical and personal narrative; district said to include "over one-third of the 384 British species."

6. COLLINGWOOD, CUTHBERT: "Birds in the Neighbourhood of Blackheath in 1854." 'The Zoologist,' xiii. pp. 4592-4. London, 1855. Lists giving dates of commencement of songs and dates of arrivals of summer migrants.

7. Do. and others: "The Fauna of Blackheath and its Vicinity." By the Geological Committee of the Greenwich Natural History Club. 46 pp., 8vo. London, 1859. Contains a list of birds.

8. CORNISH, C. J.: "Bird Migration Down the Thames" (observations at Chiswick) and "Birds on Thames Reservoirs" (Barnes Reservoir and also Wanstead Park). Two articles (pp. 65-9 and 218-23) in 'The Naturalist on the Thames.' Illustrated, 8vo. London, 1902.

9. DIXON, CHARLES: 'The Bird Life of London.' Illustrated, 336 pages, 8vo. London, 1909. A book on the subject; covers radius of fifteen miles from St. Paul's. About 130 species named, resident and visitant.

10. HALL, KATE M.: 'Nature Rambles in London.' Illustrated, xvii. and 325 pages, small 8vo. London, 1908. Bird notes on pp. 5-8, 38-44 (including a list of 50 species "said to have been seen" in Regent's Park), 61-5, 109-22, 206-13, 295-302.

11. HARTING, J. E.: "The Feræ Naturæ of the London Parks." 'Popular Science Review,' New Series x., pp. 163-172. London, 1879. Includes birds. [Reprinted in the author's 'Essays on Sport and Natural History,' pp. 222-47, 8vo. London, 1883.]

12. Do.: Articles in 'The Field' as follows:—1876 (April 22nd), "London Rookeries"; 1885 (February 14th), "Woodcocks in London"; 1886 (May 8th), "Song-birds round London";

1888 (January 14th), "Bird-life in Kensington Gardens"; 1895 (March 9th), "Sea-gulls in London"; 1898, . . . "Ospreys near London."

13. HOWE, ERNEST EDGAR: "Bird Life in the Vicinity of South-east London." 'Nature Notes,' xviii. pp. 21-6. Selborne Society, London, 1907. Eltham and Plumstead district. (Over 70 species.)

14. HUSSEY, H.: "Wildfowl in the London Waters." 'The Zoologist,' xviii. 1860, p. 6922, and xxii. 1864, pp. 9049-53. St. James's Park, the Serpentine, Round Pond, Kensington, and Regent's Park. Eight species of Duck.

15. HUTCHINSON, M.: "Arrival of Migrants" [at Blackheath]. 'The Zoologist,' second series, i. 1866, pp. 308-9. "Arrival of Summer Birds at Shooter's Hill and Neighbourhood"; *l. c.*, ii. 1867, pp. 814-9. "Birds on Blackheath"; *l. c.*, iii. 1868, pp. 1166-71. In spring of 1867, within a diameter of two miles, above 50 species seen.

16. JENNINGS, J.: "Ornithology of the Metropolis." 'London's Mag. Nat. Hist.,' ii. p. 264. London, 1829. Letter with a few notes.

17. JOHNSON, WALTER: 'Battersea Park as a Centre for Nature Study.' Small 8vo. London, 1910. Chap. iv., "Bird Life," pp. 29-48, enumerates wild birds and birds kept in confinement.

18. KIDD, BENJAMIN: "The Birds of London," with illustrations by G. E. Lodge. 'English Illustrated Magazine,' October, 1891, pp. 38-45.

19. LONDON COUNTY COUNCIL: 'Wild Birds Protection (Administrative County of London) Order, 1909,' 3 pages. Noted here as something of a curiosity for the large number of birds scheduled. Sixty-four are named, but as the generic English name is frequently given, the species exceed this number.

20. MACPHERSON, A. HOLTE: "Notes on London Birds in 1909." 'The Selborne Magazine,' xxi. pp. 65-7. London, 1910. The latest of a series of notes published annually since 1891. Of permanent value as continuous personal observations; mostly in the West End parks.

21. MAXWELL, SIR HERBERT: "London Birds," section xxiii. pp. 103-8, in 'Memories of the Months,' fifth series, 8vo. London, 1909. Review article, with comments.

22. OLIVE, CHARLES D.: "The Birds of Wimbledon." 'Wimbledon and Merton Annual,' 1904, pp. 99-119. Notes and observations with list of 68 species, "probably not complete."

23. OWEN, Prof. R.: "Birds of Lincoln's Inn Fields."

24. POWER, F. D.: 'Ornithological Notes from a South London Suburb, 1874-1909.' 60 pages. London, 1910. Not seen; only just published, Oct. 7th, 1910.

25. READ, ROBERT H.: "The Birds of the Lower Brent Valley." 'Report and Transactions of the Ealing Natural Science Society' for 1896, pp. 1-28. Also issued as a separate reprint, not dated. Annotated list of 197 species, 72 of which nest or have nested within recent years. Largest list of any district.

26. RUSSELL, HAROLD: "Birds in Kensington Gardens, 1897-8." 'The Zoologist,' fourth series, iii. pp. 84-6. London, 1899. (27 species.)

27. TODD, WILLIAM A.: "Bird Notes from a London Suburb for 1908." 'The Selborne Magazine,' xx. pp. 214-8. London, 1909. The Thames at Putney. (27 species.)

28. Do.: "Ornithological Observations in North-east Surrey, 1909." 'The Zoologist,' fourth series, xiv. pp. 75-7. London, 1910. Wimbledon Common, Richmond Park, Barnes Common, Putney Heath, and Barn Elm Reservoir. 143 species said to have been recorded; 115 seen within the last ten years.

29. TURNER, HY. J.: "Aves (Birds)," pp. 237-55 in part ii., Zoology, of 'A Survey and Record of Woolwich and West Kent. Containing Descriptions and Records . . . in commemoration of the Twelfth Annual Congress, 1907, of the South-Eastern Union of Scientific Societies.' 8vo. Woolwich, 1909. (176 species.) Includes a note on local bird writings, published and MSS.

30. VOS, GEORGE H.: 'Birds and their Nests and Eggs found in and near great Towns.' Illustrated, 240 pages, 8vo. London [not dated, but 1909]. Describes 52 species found near London, and makes remarks on about as many more.

31. WEBB, WILFRED MARK: 'The Brent Valley Bird Sanctuary.' Illustrated, 14 pp., 18mo. The Selborne Society, Brent Valley Branch, 1907. 67 species observed, including 27 nesting in a small and circumscribed area.

32. WEBSTER, A. D.: 'Greenwich Park: its History and

Associations.' Illustrated, 8vo. Greenwich and London, 1902. Contains observations and a list of 81 species found during six years, 34 of which breed ; pp. 46-9 and 50-1.

ADDENDUM.—COUNTY AVI-FAUNAS.

Books dealing with the counties bordering on London contain many observations from the district now under review, and a note of these works is here given under the authors' names.

1. HARTING, JAMES EDMUND: 'The Birds of Middlesex: a Contribution to the Natural History of the County.' Frontispiece, xvi. and 279 pages, crown 8vo. London, 1866.

2. CHRISTY, MILLER: 'The Birds of Essex: a Contribution to the Natural History of the County.' Illustrations, two plans and a plate, 302 pages, 8vo. Chelmsford, 1890.

3. BUCKNILL, JOHN A.: 'The Birds of Surrey.' Illustrations and a map, 374 pages, 8vo. London, 1900.

4. DAVIS, W. J.: 'The Birds of Kent.' Illustration (one) and a map. Dartford, 1907. East Kent almost entirely.

5. BALSTON, R. J., SHEPHERD, C. W., and BARTLETT, E.: 'Notes on the Birds of Kent.' Illustrations and a map, 455 pages, demy 8vo. London, 1907.

6. TICEHURST, NORMAN F.: 'A History of the Birds of Kent.' Illustrations and two maps, lvi. and 568 pages, square demy 8vo. London, 1909.

NOTES AND QUERIES.

MAMMALIA.

Yawning of Rodents.—In his article on the “Yawning of Fishes,” &c. (*ante*, p. 321), Mr. Elmhirst states that he can find no record of rodents yawning. It may interest him to know that my Flemish Rabbits, of which I have many, frequently, on rising from recumbent positions, stretch themselves and yawn; and a very curious expression they assume.—CHARLES H. BRYANT (38, Montpelier Crescent, Brighton).

A V E S.

Habits of the Chough (*Pyrrhocorax graculus*).—In September last I had an unusually good opportunity of watching the habits of two Choughs. The birds, probably a pair, were together on a grassy level near the coast in one of the Inner Hebrides. With glasses I could see their smallest actions. I noticed in particular that they methodically turned over the dry pats of cow-dung with their beaks, and searched underneath for insect food. When they had done this they turned their attention to some thistles in seed and picked out the down. This was not done, so far as I could see, to eat the seed, but rather from curiosity or mischief. Occasionally one or possibly both the birds (for they were not to be distinguished) would turn and caress the other by scratching the back of its head with the curved end of its bill. All these doings were characteristic of the *Corvidæ*, and the form of the bill is admirably adapted for the purposes of the bird. But when one considers the bright coral-red of the beak and the feet, which are conspicuous at a distance, it is impossible to see how this striking feature can be of service, or can have been gained by natural selection acting on small variations. It may be suggested that the red colour is a sudden mutation which has not affected the welfare of the species materially. The Choughs are undoubtedly birds doomed to gradual extermination, apparently chiefly owing to the increase of Jackdaws in their haunts. Yet why this should injuriously affect the Choughs is hard to discover, for the two species are often seen together and apparently on amicable terms.—HAROLD RUSSELL (16, Beaufort Gardens, London).

Late Eggs of Nightjar.—Mr. Corbin (*ante*, p. 339) asks whether the Nightjar may be considered double-brooded, he having had sent to him on August 15th two freshly laid eggs. I am inclined to think that the species is occasionally double-brooded, but this is not the rule. *C. europæus* is by no means uncommon in this district, and if the majority which visit it were to breed twice many more nests would have to be found in August than is the case. For three nests which are found in June not more than one is to be found in August. Mr. Corbin says:—"The two eggs in question were perfectly fresh, the yolks were intact, and without the least indication of having been incubated, although one of the birds—presumably the female—rose from the spot when approached." I have never found the male bird taking its turn in the act of incubation. Since the male is so different from the female, I think there can be no mistake in this matter. In early September I was, with an under-gamekeeper, on the border of Bingley Wood at dusk during one very cold evening, when a Nightjar came very near to us, and settled down in a pasture and began to feed upon insects, which it pecked from the grass—I thought these were "daddy-longlegs" (*Tipula*), but could not be certain. Two years ago one of my sons found a nest which contained an egg almost pure white. Some time ago a gamekeeper's wife asked me, at the instance of her husband, to examine something which he had found in the wood, which I took to be a pellet of the Tawny Owl, containing the head of a Hawfinch in a perfect condition. She archly asked if I would still continue to defend the species as a comparatively harmless bird as I had previously done? The keeper in question told me he had found the nest of a Robin with eight eggs—an unusually large clutch; the largest number I ever found was one with seven eggs. Five is about the average clutch here. — E. P. BUTTERFIELD (Wilsden).

Kestrel mobbed by Starlings.—Recently I was walking along with a few friends on an eminence overlooking a tributary of the Aire in this neighbourhood, when our attention was attracted by a phenomenon at a considerable distance above the earth, which was a source of no little wonder and perplexity to all the party. The object when first seen must have been nearly a mile away, and kept appearing and disappearing as if by magic, and, as the object came more within the field of vision, it became apparent that this protean sight was due to a flock of birds, which as they came nearer were seen to be Starlings accompanied by a Kestrel. Whenever the Kestrel began to hover or make the slightest delay in its passage through the air,

the flock of birds would concentrate and swoop down, and thus drive it away, this being repeated as far as could be seen. Every one of the party expressed the opinion that it was the most interesting sight of its kind he had ever witnessed. Mr. Fred Booth, of Saltaire, records, in the 'Yorkshire Observer,' that lately he saw a flock of Swallows mobbing a Sparrow-Hawk near Bingley. On September 12th I noticed a Swallow's nest in a pig-cote, which contained unfledged young. On inquiry I ascertained the young left the nest on or about the 21st of that month, after which they lingered round the place where they were reared for three or four days, and then disappeared altogether. About this time they nearly all left the district, although their food must have been nearly as abundant as any time during the past summer. They were flying about Sherwood Forest on Saturday (September 24th) in some numbers, accompanied by House-Martins. I think it can be safely said that both the Swallows and House-Martins are here double-brooded to a large extent, but not the Sand-Martin. One would, however, be inclined to think that the latter species is more likely to be double-brooded than either of its two relatives. The Sand-Martin is decidedly a more early arrival to this country than its allied species, but it is no less true that it leaves earlier.—E. P. BUTTERFIELD (Wilsden).

Great Crested Grebe Rearing Three Broods.—On Sept. 11th, on the ponds in Richmond Park, I saw a pair of Great Crested Grebes (*Podiceps cristatus*) with two recently hatched young ones. A keeper with whom I entered into conversation informed me that it was the third brood they had brought off this season.—R. FORTUNE (5, Grosvenor Terrace, East Parade, Harrogate).

Records of Rare Birds.—On Aug. 15th, at Frensham Pond, in Surrey, I was fortunate enough to see half a dozen Black Terns hawking for insects over the water. They were mostly adults, and very tame. There was one Common Tern with them, and a few Black-headed Gulls. At the same place I watched a Spotted Flycatcher treating a moth much as a cat behaves with a mouse. It flew with it to the top of a notice-board, and beat it or its own mandibles several times on the wood, while the moth's wings whirred audibly. It then released it, but caught it again as it made for some furze. It then let it go once more and recaptured it, after which the bird flew away with it out of sight. On Sept. 5th, at Cley, Norfolk, I saw a Black-tailed Godwit, which passed quite close to me, the wind being north-west at the time, after a gale during the night. On Sept. 20th I had two good views of a Barred Warbler, once as it flew past me,

when it looked much like a large Spotted Flycatcher, and again while it was seated in a hedge. It then, as the sun was on it, appeared a very light bird. It possibly arrived with a Jack-Snipe, which I put up from some long grass hard by. The wind was about north, and it was a lovely day after rain in the night.—E. C. ARNOLD (Eastbourne College).

Daphne-berries eaten by Birds.—Is the *Daphne*, the fruit of which Mr. E. P. Butterfield says (*ante*, p. 338) has a great attraction for Greenfinches, the *D. mezereum*, which bears purple fragrant flowers in early spring and showy, glossy red berries at the end of summer? If so, I can name another bird which eats them, but swallows the whole berry. For several years we have known that some bird took them, and have been annoyed at the loss of a pretty ornament to the garden, and also at getting no seedling plants, which come up round the trees if the berries are allowed to fall naturally. This year, with the help of my gardener (who is an observant man) and his boy, I have found out one bird at least which eats the berries. The gardener and his boy said it was a Whitethroat, and they watched it eating the berries. I did not actually see the bird eat them, but I identified the Warbler frequenting the spot where the berries were being taken (on July 29th) as a Lesser Whitethroat. The Common Whitethroat rarely comes into village gardens—being a bird of the wayside and the bushed waste—but the Lesser Whitethroat is a regular garden bird. The Greenfinches here, in late autumn and winter (when we have numbers of them), subsist largely on the fruit of the sweetbriar, of which plant there is a good deal in the garden. They are also fond of the berries of the *Cotoneaster Simonsii*, and I have seen as many as eight of them at once in a bush close to the dining-room window steadily feeding on the fruit. Greenfinches and Hawfinches feed in much the same way, mouthing the berries, or whatever their food may be, and at such times are very quiet, and rather slow and stolid in their ways, though the latter are very easily alarmed.—O. V. APLIN (Bloxham, Oxon).

REPTILIA.

A Rare Variety of the Common Viper.—While staying with my friend Mr. G. A. Macmillan in Danby Dale, not far from Whitby, I picked up on a moorland track the mutilated body of a small snake, apparently about a foot long. The small size of the vertebral column proved it a young one, and the remains of the skin made it certain that it was a Viper. This skin was of a dark bluish grey, with

a rather broad band of black down the centre of the back, instead of the usual zigzag. This puzzled me, but on referring to Dr. Leighton's 'British Serpents' I find that a single specimen has been taken with this same black stripe; it occurred at Ulverston, and was originally recorded and figured by the Rev. H. A. Macpherson in his 'Fauna of Lakeland,' p. lxxviii. The figure, which is reproduced in Dr. Leighton's book, exactly represents the appearance of my specimen, except that the stripe is hardly so broad as in the latter. Another curious thing about this discovery is that, as I am positively assured by my friends in Danby, no one has ever found a Viper in these moors south of the Esk. There is a legend (to be found, if I recollect right, in Canon Atkinson's 'Forty Years in a Moorland Parish') that St. Hilda ordered all the Vipers to depart to the north of the Esk, and turned all the recalcitrant ones into ammonites. I found, in fact, a general indisposition to believe that my specimen was really a Viper, but, as there could be no doubt about that, some consolation was found in the fact that it was a dead one.—W. WARDE FOWLER (Kingham, Chipping Norton).

INSECTA.

An Introduced Pest to Rhododendrons.—Quite recently specimens were received from a grower of rhododendrons at Fulham of an



STEPHANITIS RHODODENDRI, HORV.

insect found infesting that plant, with a request for identification. The insect belongs to the Rhynchota and the family Tingididae, and is the *Stephanitis rhododendri* described by Dr. Horváth (Ann. Mus. Hung. iii. p. 567 (1905)), and found on rhododendrons in Holland

Dr. Horváth informs me that he considers it certain that the species has been introduced into Europe, an opinion with which I entirely agree. I, however, would go further, and conclude that it has been introduced from India, it being well known that the headquarters of the genus *Rhododendron* is in the Himalayan region, and four species of *Stephanitis* are already recorded from British India. It will almost certainly be found by other horticulturists on rhododendrons in this country, and is therefore worth recording and figuring.—W. L. DISTANT.

Bees killed by Wasps.—Referring to my notes in 'The Zoologist' (*ante*, p. 337) regarding the finding of dead bees which had been picked up by Mr. Carter beneath the blossoms of some lime-trees, a few specimens of which had been kindly sent for my inspection, Mr. Carter informed me quite recently that a person at Saltaire has discovered that the perforations in the thorax were due to wasps, thus confirming the footnote by the Editor, in which it is stated that specimens of *B. lucorum*, which had been stupefied by the flowers of lime-trees, and then attacked by wasps, which made perforations in the thorax, had been sent by Dr. Günther to the British Museum. I was, however, informed by Mr. Carter that the person at Saltaire had climbed the lime-trees and actually witnessed the *modus operandi*, from which I gathered that wasps in these cases first sting the bees so as to stupefy them, after which they begin to perforate the thorax, and in many cases the abdomen, for the purpose of extracting their contents. I may say that we have kept wasp-nests in our garden for many years, but I never witnessed a wasp attack a bee (*Bombus*), although we made experiments with almost all kinds of insects. Tywort-flowers are very attractive to both bees and wasps, but I never saw the latter actually attack and kill bees, although they would drive each other away.

With regard to the observations of Mr. Selous in 'The Zoologist' (*ante*, p. 327) on Humble-Bees in relation to the flowers of the foxglove, it does not seem difficult to conceive that it may be an advantage to bees which visit certain kinds of flowers, such as the foxglove, to extract nectar from perforations at the base of the corolla in preference to entering at its mouth. Those bees which enter the flower by the latter method are more likely to become stupefied than the former. It may be said *en passant* that anyone who has even a casual acquaintance with our *Bombi* cannot but have been driven to the conclusion that no little unproductiveness is caused by such stupefaction.—E. P. BUTTERFIELD (Wilsden).

NOTICES OF NEW BOOKS.

Foreign Birds for Cage and Aviary. By ARTHUR G. BUTLER, Ph.D., &c. "The Feathered World" Publishing Office. Two vols.

DR. BUTLER has the reputation of being an ardent and successful aviculturist—in fact, as is well known to his friends, he may be said for years past to have almost lived in his aviaries. His experience has therefore been a personal acquisition, and as he is also acquainted with ornithological literature, these volumes contain many gleanings from foreign as well as British authorities. In our younger days a well-thumbed guide was Bechstein's 'Cage and Chamber-Birds,' which appeared as one of the volumes in "Bohn's Illustrated Library." In more recent times we have had 'Die Fremdländischen Stubenvögel,' by Dr. Russ, while the foundation of the Avicultural Society, with the issue of its monthly magazine, has raised aviculture to a distinct branch of ornithology. There was still more than room for an adequate work on the subject, and little doubt can be felt that Dr. Butler has supplied that demand.

It is probable that among humbler and less wealthy folk the keeping of birds in captivity as treasured pets has diminished. The birdcatcher is now much less in evidence; in our schoolboy days he constituted a distinct item in most rural landscapes, and our petty cash at that period was largely devoted to the purchase of such rarities as the "Kiss-me-dear Chaffinch," the Song-Thrush with the true wild note, the "Aberdevine," and other treasures originally derived from the store-cages of these gentry. On the other hand, the aviaries of the more financially blessed have now supplanted the cages, often dungeons, of the poor, and this perhaps should be considered no small gain. At that time also foreign birds were to be more frequently seen, and too often in contemptible cages, for sailors then brought home pets for their friends, which also for themselves beguiled the long voyage and

cheered the dreary forecastle. This practice has greatly fallen in disuse; sailing-ships will soon be but shadows, and rules are more stringent on steamships.

Dr. Butler's first volume is devoted to "the smaller foreign birds," and the second volume to the larger species. In the two volumes there are described "about a thousand species of cage-birds," with directions how to feed and how to house them; while the ornithological gleanings from other writers constitute material for the production of another of those *modern* tractates on natural history with which the printing presses now heave. Before taking leave of these volumes we will give one extract:—

"It has often been incorrectly asserted, and Darwin has repeated the error in his 'Descent of Man,' that 'the power of song and brilliant colours have rarely been both acquired by the males of the same species.' To those who have kept a great many species, it is well known that many of the most gorgeously coloured birds sing remarkably well: amongst the Thrushes, the Blue Rock-Thrush is one of the finest songsters, *Leiothrix* is a notoriously grand songster, several of the gorgeous Tanagers sing sweetly, the flaming Virginian Cardinal is an acknowledged vocalist of merit, and many of the brightly coloured Finches sing excellently; the *Icteridæ* (with their startling contrasts of yellow, orange, scarlet with black and white) number not a few fine singers in their ranks, the Fruit-suckers of the East (*Chloropsis*) are fine performers, and we have one of the most brilliant of all living birds—the King Bird of Paradise—gifted with a love chant not unlike that of the Skylark."

This publication should find many constant readers in this country. We wish we had had it with us when in South Africa.

Check-list of North American Birds. Prepared by a Committee of the American Ornithologists' Union. Third edition, revised. New York: American Ornithologists' Union.

THE first edition of this List was published in 1886, and the second (revised) in 1895. The changes in nomenclature from the second edition are numerous, and are due, we are told, mainly to two causes: "The recent unprecedented activity in bibliographic research, abroad as well as in America, and the strict application of the law of priority." Many generic changes have resulted from raising to generic rank various groups recognized only as subgenera in the first and second editions of the List. This is a welcome reform; a subgenus is frequently a

hindrance, for a genus itself is only a more or less imaginary quantity used in classification, and valid by the useful purpose it serves.

The classification is unchanged, though recognized as not now reflecting current views. "The fact, however, that present systems of classification in ornithology are admittedly tentative, and differ widely among themselves, it seemed best, from the standpoint of convenience, to continue the old Check-list system unchanged," since the users of it are familiar with the present order of arrangement. In the opinion of the Committee, however, a slight modification of the system proposed by Dr. Hans Gadow in 1892 would best reflect our present knowledge of the classification of birds. Few workers will cavil at these decisions, and it makes for edification to again refer to the title-page, and read the golden maxim: "Zoological Nomenclature is a means, not an end, of Zoological Science."

Among other excellent features in this List is the mention not only of the type of each genus, but the statement also of how the type was determined, a matter frequently of vital importance in these days of somewhat arbitrary identification. A reference to the original description of each genus and species is given, synonymy being wisely eschewed in a Check-list. Trinomial designations are, however, not eschewed, and these, of course, will be received by different workers in diverse appreciation. The volume has been produced with much care and by an able Committee; it will be valued by working ornithologists outside the North American faunistic area.

A List of British Birds, showing at a glance the exact Status of each Species. By W. R. OGILVIE-GRANT. Witherby & Co.

THIS Catalogue is devised for labelling specimens or for reference, and may prove a successor to the List published by the late Mr. Saunders in 1907, which, as so many additions to the British Avifauna have been made since then, "is now out of date." The classification commences with the *Phasianidæ* and terminates with the *Corvidæ*. It is more than a mere list, the descriptive notes as to the status of the rarer species alone lifting it out of that category; while by a columnar process we are

at once informed whether the species enumerated is:—"1. Resident. Breeds. 2. Regular summer visitor. Breeds. 3. Regular autumn, winter, or spring visitor. Does not breed. 4. Occasional visitor. Used to breed. 5. Occasional visitor. Never known to breed." Being printed on one side of the paper only, the convenience for scissors and labelling is self-evident.

An Account of the Alcyonarians collected by the Royal Indian Marine Survey Ship, 'Investigator,' in the Indian Ocean.
By J. ARTHUR THOMSON, M.A., &c., and J. J. SIMPSON, M.A., &c.; with a Report on the Species of Dendronephthya, by W. D. HENDERSON, B.Sc., &c. Printed by Order of the Trustees of the Indian Museum, Calcutta.

THE name of the 'Investigator' is now well known in the records of Indian oceanic zoology, and the material that it has been the means of bringing home for study is probably still far from being exhausted. The present volume (ii.) is devoted to a description of the Alcyonarians of the Littoral Area, and is a continuation of a previous memoir (Thomson and Henderson, 1906) dealing with the Deep-Sea forms. In the Introduction we are told that both Mr. Simpson and Dr. Henderson performed a very considerable portion of this work during their tenure of Carnegie Scholarships and Fellowships, and that the Carnegie Trustees have also defrayed the expense of drawing four of the plates, and of the zinc-blocks made for the text-illustrations.

The general result as regards geographical distribution of species is that a large number are common to the Indian Ocean, and to such localities in the Pacific Ocean as Borneo, Sumatra, Java, Sulu Sea, Arafura Sea, Banda, Japan, Formosa, Torres Straits, and North-West Australia. This is analogous to the distribution of some terrestrial families of the Insecta. The collection includes 187 species (61 belonging to Dendronephthya or Spongodes), 108 are new, and it has been found necessary to establish four new genera. Besides the textual illustrations there are nine plates, two of which are coloured.

In these days, when special studies are the most that can be attempted by zoologists, to many the descriptions and illustrations of these living forms will prove somewhat of a revelation.

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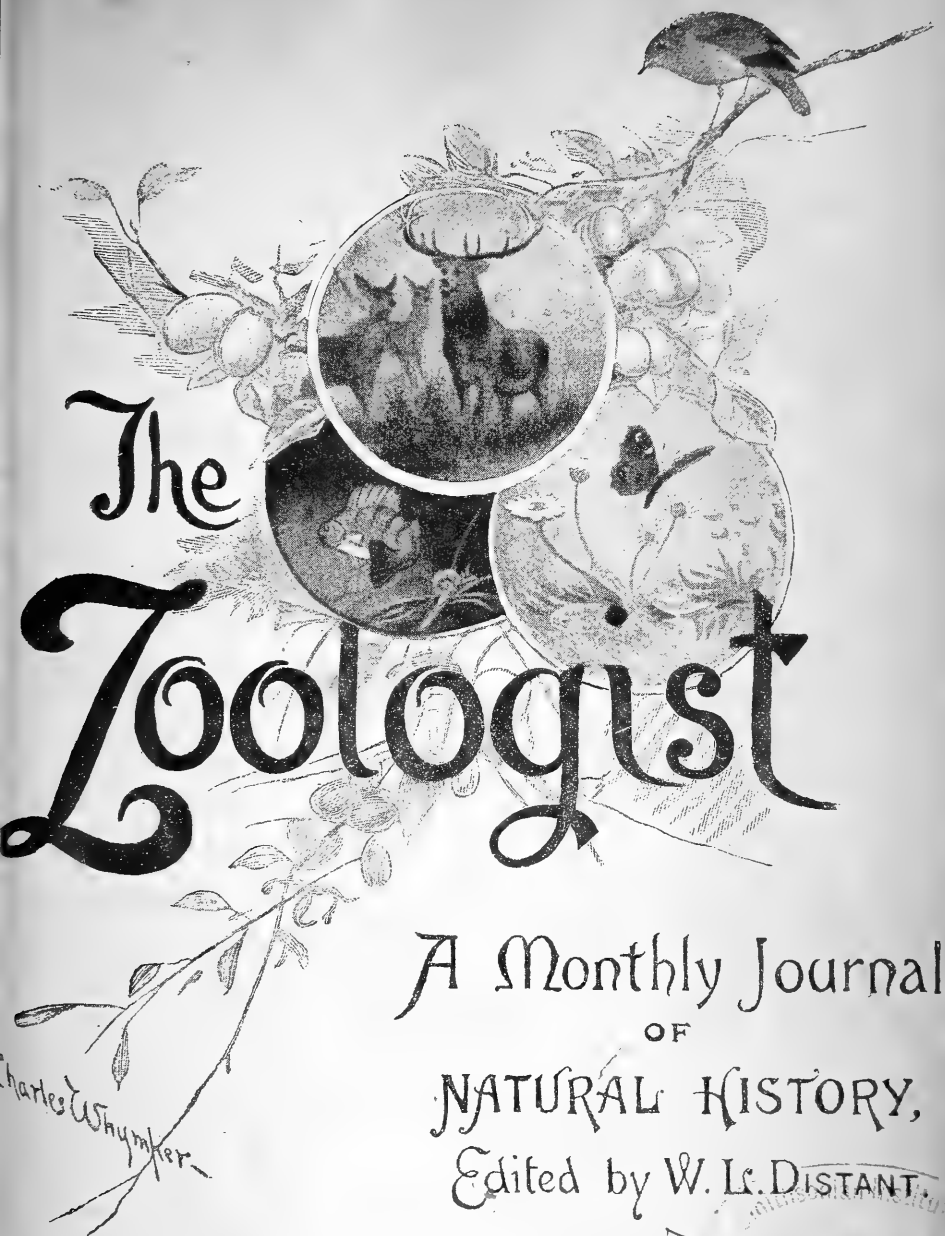
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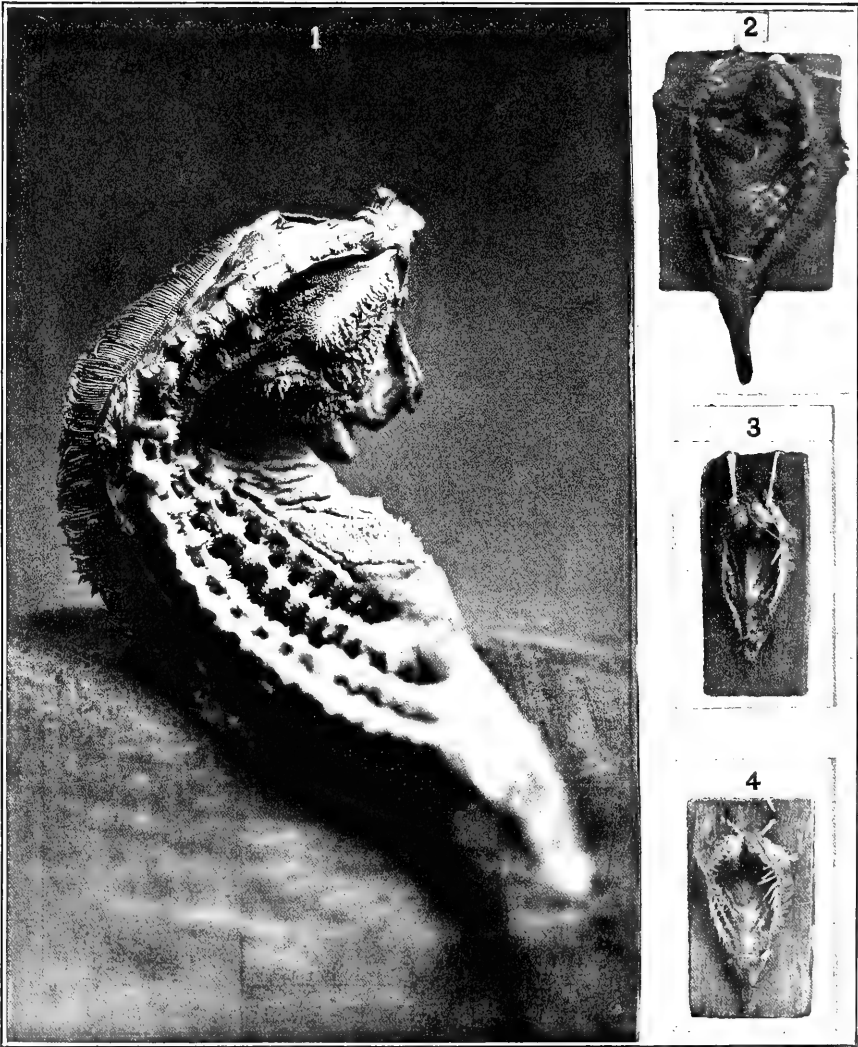
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THE ZOOLOGIST

No. 833.—November, 1910.

THE WILLOW-WRENS OF A LOTHIAN WOOD.

(WITH MAP SHOWING POSITION OF NESTS IN 1910.)

By S. E. BROCK.

Description of Wood.—The plantation with which the following remarks deal is situated in the north-east of Linlithgowshire, within a mile of the Midlothian border. It lies at an altitude of rather less than 200 ft., is 25·999 acres in area, and is of very mixed growth. Briefly described, the south and north-west sections consist of thickly planted Scots-fir and spruce of considerable age, shading the ground so closely that undergrowth hardly survives except round the outskirts. The central and eastern portions—which together include the larger part of the whole wood—contain an irregular growth of young Scots-fir and larch, chiefly the former, averaging 12–15 ft. in height. Round the edge of the wood is a broad border of well-grown trees of various species—elm, ash, oak, Spanish chestnut, &c.—together with such bushes as elder and guelder-rose. To the north the wood ends in a long narrow strip, mainly deciduous in growth. A wide ride runs round the outer edge; a narrower one extends north and south through the centre; while a small burn flows through from west to east. Main features of the undergrowth are clumps of ferns of three species (*Athyrium filix-fœmina*, *Lastræa filix-mas*, and *L. dilatata*), and, in the more open parts, clumps of *Phalaris arundinacea*—beloved of Whitethroats—and beds of rose-bay (*Epilobium angustifolium*).

The fact that open spaces are scarce except in the vicinity of the rides must be taken into account in considering the positions of the nests.

Methods of Arrival and Departure.—In the case of the Willow-Wren, as in most of our summer migrants, the male birds reach the breeding-grounds in advance of the females. In this district the first arrivals usually show themselves during the third week in April, the average date being about the 19th of that month. The filling-up of the area takes time, and is seldom complete—even as regards the males—until May is in. The arrival of the females commences about a fortnight after that of the earliest males, and appears to extend, as a rule, over a shorter space of time. In a favourable season the whole migration of both sexes may be complete in about three weeks, but in a broken spring this is otherwise. For example, in 1910, which had a particularly barren April, with an unusual prevalence of strong cold north-west winds, the arrival of Willow-Wrens was exceptionally irregular and protracted. Thus, while the first males reached the wood on April 21st, only a third of the whole had settled down by the end of the month, and the population did not approach completion until May 8th–9th (there was evidence elsewhere of males continuing to arrive as late as May 20th). A close watch for females revealed none before May 15th, and the bulk of them arrived with a rush between that date and the 18th. A table may make this arrival clearer:—

Date.	Wind.	Male birds present in wood.	Date.	Wind.	Male birds present in wood.
April 20.....	W. light.....	—	May 1.....	N.W. moderate ...	6
„ 21.....	N.W. strong	3	„ 2.....	„ „	7
„ 22.....	W. light.....	3	„ 3.....	S.W. strong.....	6
„ 23.....	W. very strong...	3	„ 4.....	N.W. moderate ...	6
„ 24.....	W. light.....	3	„ 5.....	„ „	9
„ 25.....	N.W. light.....	3	„ 6.....	N.W. strong	9
„ 26.....	N.W. strong	3	„ 7.....	„ „	8
„ 27.....	„ „	3	„ 8.....	N.W. light	17
„ 28.....	„ „	5	„ 9.....	„ „	20
„ 29.....	„ „	6	(May 10–18, weather quiet, with light easterly winds. Female Willow-Wrens mostly arrived May 15–18.)		
„ 30.....	„ „	6			

(The census of the wood was taken in the afternoons, as through-passage males were frequently present in the early hours of the day; almost invariably these had passed on by midday.)

The facts of departure from nesting-haunts are always more difficult to grasp than those of arrival. It seems, however, that many of the adult Willow-Wrens leave their breeding-grounds in the end of July, and perhaps the only birds remaining are those with late broods. This departure, however, is largely concealed by the leisurely through-passage of the birds from further north. Young birds commence to wander as soon as they are independent of their parents, and by mid-July, in a normal season, many show themselves in gardens and other spots hitherto strange to the species. Through-passage of northern birds continues throughout August, but rapidly thins out in September, and usually all have passed on by the end of that month.

Distribution of Pairs and Nests.—In 1910 the wood, which, as already stated, is 25·999 acres in extent, held twenty-two pairs of Willow-Wrens, and, in addition, what appeared to be two unmated males. (The “song-centres” of these two birds are indicated in the map thus: XXIII, XXIV.)

That mateless birds occur, even amongst our small Passerines, can scarcely be doubted. The fact, when it exists in such an abundant species as the Willow-Wren, is not very easy to appreciate, but in one or two other warblers, notably the Blackcap, I yearly meet with instances. In this county—unlike its relative the Garden-Warbler, which is generally, though sparingly, distributed—the Blackcap is local and somewhat irregular in appearance. The fact that males are more abundant than females has been repeatedly indicated by the arrival of scattered birds of the former sex in spring, which settle down in suitable haunts for some weeks, and, failing to procure mates, wander away into fresh ground in June or early July, whereas those few which are mated remain until August. The same phenomenon is to a lesser extent apparent in the Garden-Warbler. It is probably these wandering, unpaired birds which so frequently show themselves at curious times of the year in localities where none of the species breed. Thus, I have records of solitary male Blackcaps appearing in non-breeding spots in June 27th, July 2nd, July 3rd; Garden-Warblers on July 1st, July 7th; and Wood-Wrens on June 20th, June 22nd.

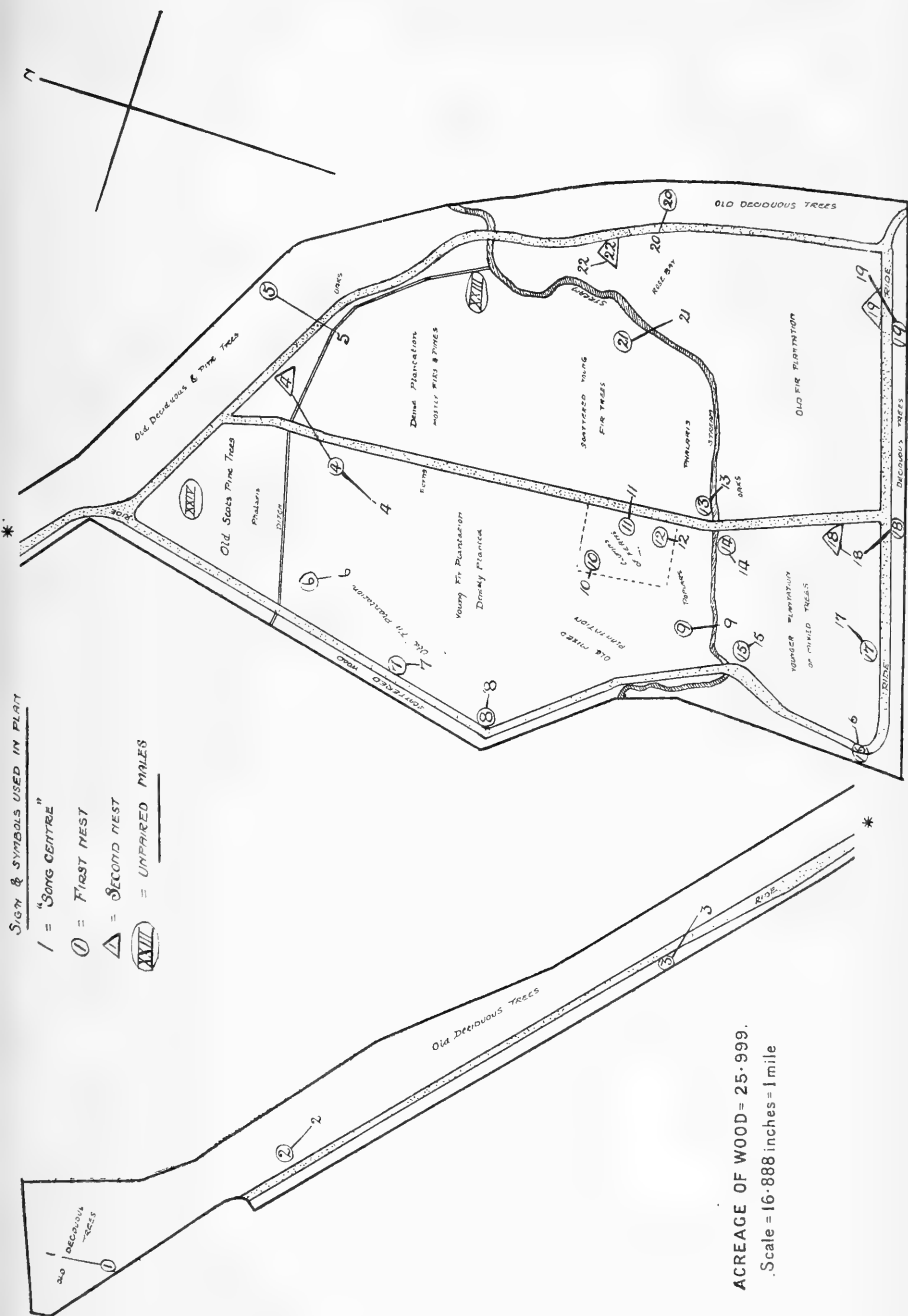
Another local instance, somewhat similar to those of Black-

cap and Garden-Warbler, is the Sedge-Warbler. In 1908, owing to disaster during migration or other cause, there was a great shortage in the number of Sedge-Warblers, and several nesting areas, including the wood with which this article is specially concerned, were entirely deserted by the species. No recovery in numbers was apparent in 1909, but in the following spring some of the former haunts began to fill up, and three males settled in the wood. But only one of these obtained a mate and nested, the other two remaining solitary throughout May and into June, disappearing altogether in the latter month.

These three cases of Blackcap, Garden-Warbler, and Sedge-Warbler seem to afford some evidence that the males are the pioneers in the settling of new breeding areas. The fact that the females follow them in smaller numbers is at least suggestive of numerical inferiority in that sex.

Returning to the Willow-Wren. The accompanying map, for the preparation of which I am indebted to my friend Mr. R. M. Adam, shows the position of twenty-five nests, twenty-one of which are first broods. It will be noticed that these nests are somewhat irregularly distributed throughout the wood, more so than the singing-posts of the males. This is to be partly explained by the fact that, while the males show little preference in the choice of their singing-posts, the females dislike dense cover for their nests, and the latter are consequently placed in whatever open spaces are readily accessible.

It is necessary here to say a few words on these singing-posts and their relation to the nests. On reaching their breeding-haunts the males soon settle down into regular beats, confining their feeding-excursions within certain more or less definite limits. The areas comprised within these limits have been designated the "territories" of the birds, and the term is a convenient one, since such restricted areas do undoubtedly exist amongst many of our summer birds. At the same time my experience leads me to doubt whether too much stress has not been laid on the precise and sharp demarcation of these territories. Speaking here solely of the Willow-Wren, it seems that the facts are roughly as follows: In each territory there exists a tree or group of trees chosen by the male as his headquarters, and here a large proportion of his time is spent prior to the



arrival of the female; less during pairing-time; again more during incubation; and less during the rearing of the brood. While these singing-posts—or “song-centres,” as they may be called—are only exceptionally intruded upon by neighbouring males, adjacent territories may overlap—that is to say, their outlying parts may be common to two or even more males. This mutual encroachment of different birds is most pronounced, naturally, in woods thickly populated by the species. Further, on the arrival of the females, the males extend their rounds temporarily, visiting spots hitherto ignored, and, as will be repeated presently, nests may be built in such places. In short, it would be quite impossible, without drawing too largely on the imagination, to mark off in the map of this wood definite boundaries dividing the individual territories from one another.

From the nebulosity of the dividing lines it follows that neighbouring birds frequently meet. When this happens, conflicts may take place, but quite as frequently the birds ignore each other. Males are the more jealous, but on occasion I have known the females attack and drive away others of their sex.

The choice of the nesting-site appears to lie with the female, and it may be pointed out that, of the twenty-one first broods in the wood, in no instance was the nest situated immediately beneath or beside the male's song-centre; usually it was at some considerable distance, and in a number of cases in ground not previously included in the male's beat. This latter fact, perhaps, need not surprise one. There is nothing to show that the female has any cognizance of what constitutes the limits of her mate's territory. Certain it is, at any rate, that she repeatedly passes beyond these limits, and in some cases nests outside them. An interesting illustration of the latter case is furnished by the three nests, Nos. 10, 11, 12. Here an open fern-grown piece of ground, nearly clear of trees, and surrounded on all sides by thick growth, has been selected by three different females for nesting-quarters, although none of the males included this part within their territories. Two of the nests were situated only thirteen yards apart. At the same time it seems that in woods of thin growth the nests tend to be on the

average nearer the song-centres. No doubt in this respect, as in others, environment is not without effect on the habits of the birds.

It may, perhaps, be not altogether superfluous to give from my notes one or two short extracts, selected as illustrating different points in the relationship of neighbouring pairs of birds :—

“May 20th, 11 a.m. : Watched Willow-Wren building. The situation chosen for the nest is apparently outside the male’s territory, since on all previous visits he was never observed to approach nearer than a point some fifteen yards distant. To-day, however, he was notably much more restless than usual, being incessantly on the move, and frequently visiting spots previously unknown to him. . . . A third bird (female ?), during the half-hour I remained, was frequently feeding quietly within a few yards of the nest. Though it could not but be visible to the other birds, no attention was paid to it.

“May 21st, 3.30 p.m. : . . One bird, whose usual singing-post is in a wild cherry-tree, was observed to fly straight into the fir-clump, fifty yards away, which is the central point in the neighbouring bird’s territory. Here it remained for some minutes, singing quietly, and then returned without molestation.

“May 20th, 3.50 a.m. : . . . Once the male from the next territory had penetrated almost to the quarry (the song-centre of male No. I.). Male No. I. soon noticed him, and pursued him instantly, chasing him for a long distance beyond his own territory.

“May 24th, 3 p.m. : Two pairs of birds watched. The males were frequently in close proximity to each other. On one occasion they were singing in two neighbouring trees whose branches interlaced. No jealousy shown. The female of pair No. I. several times wandered into the territory of the other pair, and once passed right through it to some unoccupied ground on the other side. This bird was watched building her nest—which is still unlined—in the top of a high bank within a few yards of the favourite tree of male No. II. Male No. I. kept in fairly close attendance on her, occasionally uttering the buzzing note, and passing from tree to tree in sluggish flight.”

TABLE OF NESTS.

No. of Nest.	Site.	Direction of Opening.	Approximate Distance from "Song-centre."	Distance from nearest Nest.	Date of Laying.	Date of Fledging.	Clutch.
1	Side of grassy bank	west	15 yards	115 yards	(May 30)	June 30	6
2	Amongst dead grass-grown branches	south-east	12 "	115 "	(May 27)	June 27	6
3	In long rough grass, 1 ft. above ground	south	25 "	197 "	June 17	(nest deserted)	(incomplete)
4	Side of grassy bank	west	16 "	45 "	(May 23)	June 22	5
5	Base of fern-clump	east	40 "	45 "	June 2	July 2	6
6	" "	south	20 "	42 "	May 25	June 26	6
7	Amongst dead leaves	south	25 "	42 "	(May 21)	June 22	7
8	Amongst dead grass-grown branches	south-east	24 "	68 "	May 26	June 28	6
9	In <i>Phalaris</i> clump	south-west	20 "	30 "	May 27	June 28	7
10	Amongst long grass	north-west	15 "	18 "	(May 28)	June 27	5
11	Base of fern-clump	south-east	30 "	13 "	June 4	July 4	5
12	" "	north-west	22 "	13 "	(May 23)	June 25	7
13	Amongst long grass	south-east	19 "	10 "	(May 30)	June 30	6
14	In <i>Epilobium</i> bed	west	14 "	10 "	May 27	June 26	6
15	In nettle-bed	east	18 "	30 "	May 24	(young destroyed)	8
16	Amongst dead branches	south	25 "	58 "	May 28	June 29	6
17	In <i>Epilobium</i> bed	east	15 "	58 "	May 27	June 25	6
18	In grassy ditch below bramble-bush	east	30 "	71 "	May 26	June 26	5
19	Amongst dead grass-grown branches	west	23 "	50 "	(May 25)	June 25	6
20	" "	east	35 "	62 "	(June 17)	July 16	4
21	In <i>Phalaris</i> clump	north	30 "	41 "	May 24	June 26	7
22	(Not discovered)	?	?	?	?	?	?

(Laying-dates within brackets are approximate only, the nests not being discovered before commencement of incubation. These dates are somewhat later than usual, the season being a backward one. The usual laying-time in this district is about May 20th.)

The two late nests, Nos. 3 and 20, may possibly have been second attempts due to the first nests having been destroyed, but I believe the more probable explanation to be that the females in these cases were merely slower in attaining breeding condition than their neighbours.

Willow-Wrens are successful beyond many birds in their nesting. Of the twenty-one nests in a wood by no means innocent of Stoat and Weasel, probably the most dangerous enemies of ground-nesting birds, only two came to grief, one being robbed when the young were half-grown, and the other deserted.

Addled eggs are less frequent in this species than in many others. Only one egg out of one hundred and twenty failed to hatch, and this exception was a dwarf specimen, the first-laid egg of nest No. 14. Compare with Hedge-Sparrow or Yellow Bunting. Whether there is any particular bias as to the direction the nest should face is doubtful. In the foregoing list there appears to be a tendency to avoidance of north, but in order to decide the question it would be necessary to collect statistics of a very much larger number of nests. Unfortunately this detail has been neglected in previous years' records.

After the fledging of the young the nests were taken to pieces and their composition fully noted. These have been omitted from the table to avoid a redundancy of details. Considerable variation occurred. The following case (nest No. 15) may be taken as representative, description commencing with exterior: Few dead leaves; little moss and dry fern-fronds; much dry grass, coarser at first, and of finer materials in inside cup, which is also much more closely interwoven; lining of a few horse-hairs, rootlets, and one hundred and twenty feathers, mainly Pheasant's. Dead leaves, moss, and fern-fronds are not always used, and the lining of horsehair and rootlets may likewise be absent. The feather lining is not always quite distinct from the grass material, *i. e.* the bird, after having commenced the lining, may add further grasses amongst the feathers. The quantity of feathers used varied between fifty and two hundred and twenty in number. Eleven nests had a predominance of Pheasant's feathers; six showed preference for those of Ring-Doves; the remainder were more varied.

The commonest clutch is six. Thus there are: 1 four, 4 fives, 10 sixes, 4 sevens, 1 eight; while the clutches of the four second broods were 3, 3, 4, 4 respectively. The size of clutch in birds is sometimes a little loosely stated. Most authorities give the Willow-Wren's clutch as six to nine or five to eight. But four is not a rare clutch, and three is found now and then—even with first broods. There can be little doubt that in this matter as in many others there is considerable local difference, and detailed lists of clutches from each county in Britain—if we had them—could not fail to be of considerable interest from several aspects. To be of real service, however,

such lists would require to include a large number of nests, and also to extend over a series of years, since it seems that—whether the cause be directly climatic, or through the food-supply*—there is variation in different seasons.

It seems probable that in the Willow-Wren, as in so many other birds, the same nesting-haunts are resorted to in successive seasons by the same individuals, and this no doubt applies to both sexes. Where different pairs breed in such close proximity, as in the present species, evidence is somewhat difficult to collect. The best instance in the wood is perhaps that of pair No. 19. In 1908 this pair nested in a small spruce-bush, about two feet from the ground. The following year (1909) the nest was built amongst some prostrate grass-grown dead branches, twenty yards away from that of the previous season. The 1910 site was within eight yards of the 1909 one, in a similar situation, and, most interesting of all, the second brood was reared in the 1908 nest in the little spruce-tree, which, owing to its sheltered position, had remained practically intact for two years. It was used by the bird without any repair beyond the addition of a few fresh feathers in the lining. This adaptation of an old nest in the Willow-Wren is unique in my experience. It is perhaps reasonable to assume that one female was responsible for all three nests. Although only eight first broods and five second broods were located in the wood in 1909, it may be worth while to state their relationship to 1910 nests. Excluding the instance just cited, the facts are:—

Of seven first nests in 1909, five were within fifty yards of 1910 sites (first nests): 5, 6, 40, 40, 48 yards respectively.

Of five second nests in 1909, four were within fifty yards of 1910 sites (first nests): same spot, 2, 30, 49 respectively.

The remaining two first nests and one second nest were at greater distances.

General Habits.—Broadly speaking, male Willow-Wrens may be said to pass through four stages after their arrival in their breeding-haunts, each stage being marked by characteristic behaviour. There is, first of all, the period previous to the

* Age is another probable factor, not necessarily constant in its application, since the proportion of young breeding birds may vary yearly.

arrival of the females ; secondly, the period between the latter's arrival and the commencement of incubation ; thirdly, the interval during incubation ; and, lastly, the extent of time between the hatching of the young and their becoming independent of their parents.

During the first period—that previous to the arrival of the females, which may extend from a fortnight to nearly a month, as in 1910—the life of the males is a systematic and regular one. Commencing their song in the morning a little before sunrise (one of the last birds to do so, being frequently an hour later than such early birds as Sky-Lark or Song-Thrush), they sing most persistently and regularly for the first hour or two, feeding little, and spending the greater part of the time in the “song-centre.” They are decidedly more sedentary than later in the day, frequently remaining motionless on a twig for several seconds together, only their heads moving restlessly. The songs are loud, and uttered with the utmost regularity, with pauses between of about ten seconds in duration. As the day advances they begin to feed with greater freedom, and extend their excursions, but still exhibit distinct preference for one particular part of their territory. Fights with neighbouring birds are frequent, though seldom very earnest, usually consisting merely of an aerial twirl or two, accompanied by a little menacing bill-snapping ; during these encounters snatches of the song may be uttered in a low tone.

On the arrival of the females the commencement of the second stage in the male's year is evidenced by a marked change in behaviour. In place of the comparatively sedentary habit, and loud, regularly uttered song distinctive of the previous period in the early hours of the day, an extreme restlessness becomes apparent, and the song is now low in tone and very irregular in utterance, whole minutes together of silence sometimes elapsing. For the time being the song-centre is almost entirely deserted, and incessant wandering over a wide area becomes characteristic, this wandering frequently taking the male beyond what has hitherto been the confines of his beat. It is at this time, too, that a low “cheep, cheep” begins to be uttered between the songs, and this feature becomes more prominent as the days elapse. He follows the female at varying

distances, his body and wings occasionally shivering with suppressed excitement, and now and then, on approaching her very closely, he utters a strange trilling or "buzzing" note—impossible of translation—waving his wings gently. At other times he will dart at her, and pursue her with lightning speed through the trees. Again, after remaining for a few seconds on an upper bough in a motionless and curiously constrained attitude, he will float downwards towards the female with slow-flapping wings—a dainty performance, which lives in the memory. The female is much less demonstrative, the only sign of emotion being an occasional shiver of the wings.

Although much more frequent and energetic during the first hours of daylight, these "courting" habits are commonly in evidence in modified form during the day. I have witnessed them as late as 5 p.m.

Coition, her readiness for which the female signifies by a gentle waving motion of the wings, takes place at various times of the day, most frequently, apparently, in early morning, but at times late in the afternoon. In two pairs of birds this year (1910) it was first noticed three and two days respectively before the laying of the first egg. Probably each egg requires separate fertilization, although it is a matter of very great difficulty to obtain complete evidence in wild birds. It is certain, at any rate, that more than one pairing may take place; I have noticed coition in species representative of such widely different families as Willow-Wren, Moorhen, and Long-eared Owl, after part of the clutch had been deposited.

Nest-building devolves entirely on the female. I have at least never yet seen the male take any share in the work. While it is in progress he pays only irregular attention to his mate, pursuing her playfully on occasion, but frequently wandering some distance away from her. Restlessness and excitability still mark him however. Materials are usually fetched from only a short distance, and the hen frequently gets into the habit of visiting certain spots in search of them, even giving herself unnecessary trouble to do so. The rate of construction appears to depend largely on the physical condition of the female, and in some cases is very rapid, building proceeding at intervals all day, and nests may contain the first egg within six days from

the date of the commencement of building. Egg-laying seems to take place usually from 4 to 6 a.m., the birds leaving their nests again before 9 o'clock. There are exceptions, however. For instance, one bird (No. 18) did not lay her first egg until after 10 a.m.; the second was deposited before that hour on the succeeding day; and the third between 10 and 11 a.m. on the third day. One egg is laid each day. As the eggs increase in number the birds begin to sit for longer periods, and incubation may commence before the full clutch is deposited. In this respect there is great variation, some birds incubating from the fourth or fifth egg, others waiting until the clutch is complete, and, exceptionally, even a day longer. The hatching of the young, consequently, may extend over a day or two.

During the laying of the eggs, and before incubation has commenced, the male continues to pay considerable, though intermittent, attention to the female. His behaviour, however, undergoes some slight modification. His excitement decreases, he becomes more sedentary, and his song, although still low in tone, is uttered more frequently and is unusually prolonged, the "cheep" note being almost invariably interpolated. On the female going on to lay, he escorts her to the nest, and then, deprived of her stimulating presence, he shows a tendency to revert to his old habits of the period previous to her arrival. He returns to his old "song-centre" and resumes his customary mode of life; the song becomes louder and more normal, the "cheep" note being comparatively little uttered. This note, however, persists with some males throughout the summer; the mental attitude underlying it is difficult to appreciate.

With the commencement of incubation, the third stage in the male's year, already foreshadowed during laying-time, comes into being. The habits of this period are largely a repetition of those of the first. The "song-centre" regains its ascendancy, and from that point of vantage the old excursions round the area recommence, varied by indeterminate tussles with other males. I have not observed them feed their mates during incubation; they may do so exceptionally, however, since I have seen them carry food to the female as she sat brooding newly hatched young. (It is in fact dangerous to generalize; no two birds behave exactly alike throughout the season.) They rarely go

near the nests, only chasing the females playfully when the latter are on their short feeding-excursions.

The hens sit very constantly, only leaving their nests for a few minutes in search of food at various times of the day, but apparently chiefly in early morning and again about sunset. Incubation lasts twelve to thirteen days, the young spending thirteen to fourteen in the nest. These are average periods; here again there are differences, sometimes puzzling, between neighbouring nests—in one case, nearly fifteen days were required for incubation. The shortest time spent in the nest by broods is twelve days, but thirteen or fourteen is more common. If disturbed, they are able to flutter out when only nine or ten days old. When the young are still only a day or two old much time is spent brooding them, the female feeding them once or twice, and then covering them for a considerable interval before going off for a fresh supply of food. These intervals of brooding decrease in extent day by day, and cease finally when the young are about eight days old. At this stage, too, the female no longer broods them by night, and roosts elsewhere; but this may be merely a question of room—six or seven nearly fledged Willow-Wrens in a nest are a lesson in tight packing! With the hatching of the young the male normally enters on his fourth stage. He takes, as a rule, a fair share in the rearing of the family, and less time is consequently passed in the “song-centre.” The song, however, continues practically unabated, being repeatedly uttered while the bird’s bill is full of caterpillars. Some males commence to assist their mates as soon as the young are hatched; others ignore the latter for some days. In one case the male only tardily realized his duties when the young were nine days old. The following notes, referring to nest No. 8, when the young were three days old, may be taken as typical of that stage; here the male had not yet taken any notice of the young birds, though he did so a little later on:—

“June 16th, 11.50 to 12.50 p.m.:—11.50, female on nest; 11.55, female left nest; fed young 11.58, 12.0, 12.10, and then brooded until 12.20; fed young again 12.23, 12.26, 12.29, 12.32, 12.36, and then brooded until 12.45; had not returned by 12.50. Thus in the hour she fed the young eight times, and brooded them for intervals of ten and nine minutes.”

Another record, referring to nest No. 16, when the young were a few days older (six days old):—

“June 21st, 10 to 11 a.m.:—10.1, male fed young; 10.2, female fed and then brooded; 10.5, male fed; 10.9, male fed; 10.10, female left nest; 10.11, female fed; 10.12, male fed; 10.17, female fed; 10.23, male fed; 10.24, female fed; 10.25, male fed; 10.27, male fed; 10.28, female fed and then brooded; 10.29, male fed; 10.30, female left nest; 10.30, male fed; 10.31, female fed and then brooded; 10.32, male fed; 10.37, male fed; 10.37, female left nest; 10.38, both fed; 10.39, female fed; 10.40, male fed; 10.42, female fed; 10.43, female fed; 10.45, female fed and then brooded; 10.47, male fed; 10.58, female left nest.” Summarizing: the male fed the young fourteen times in the hour; the female fed them eleven times, and brooded for four intervals of eight, two, six, and thirteen minutes.

A very large proportion of the food brought to the young consists of insect-larvæ. The quantity destroyed must be enormous; a rough calculation showed that the young broods in this wood, when nearly fledged, must have consumed a minimum of something like 7500 larvæ per day! It is an interesting fact that after the young have left the nest, larvæ form a much smaller proportion of their food, the imagos of Diptera, and apparently certain Heteroptera (*Psallus*, *Phytocoris*, &c.), becoming the chief resource. The second broods are also fed principally on Diptera, both before and after leaving the nest. This change of food, however, may be merely a local phenomenon, due to increase or decrease in certain forms of food. The fledged young remain in charge of the female—the male takes less interest in them—for some ten days after quitting the nest. The first day or two of this period is spent in the vicinity of the deserted nursery, but as the young gather strength and confidence, they soon begin to wander into new ground, the female accompanying them. Soon they become quite capable of feeding themselves, picking insects off the leaves and springing after those on the wing with the skill of a Flycatcher. Towards the end of the ten days, the old bird ceases altogether to act as food-provider, and becomes merely the sentinel of the family, ever watchful for sign of danger. By the middle of July

many of the young birds, recognizable by their yellow plumage and immature call-note, leave the place of their birth altogether, wandering leisurely southwards.

Judging from the systematic observation of the last two years in this wood, it would appear that the local proportion of Willow-Wrens having second broods is about fifteen to twenty per cent. In 1910 there were four second nests, from three of which broods were reared, one having the eggs destroyed. (These nests belonged to pairs Nos. 4, 18, 19, 22; they are indicated in the map thus \triangle .) The intervals between the fledging of the first broods and the commencement of laying for the second clutch were, in three of the cases, approximately ten, fifteen, and eight days respectively; the sites being seventeen, twenty, and fifty-five yards distant from the first nests. As already stated, the food of the second broods, both while in the nest and after leaving it, consists chiefly of *Diptera* in the mature form—a decided contrast to that of the first broods. Another point of distinction is that the males frequently take no share whatever in the feeding of these late families. This was the case in all three second broods reared in 1910, although in each instance the males had taken their share with the earlier families. The explanation appeared to be that they had by that date (late July) already departed from the locality, leaving their more dutiful mates to their own resources. In the previous season, however, when the broods were a week earlier, the males in some cases assisted in their rearing, so that there is no invariable rule in the matter. The rate of feeding is decidedly more rapid with these second broods. Thus while first broods, when nearly fledged, are fed (by both parents) from fifteen to thirty times in the hour, second broods at the same stage of development—even when tended by the female alone—are fed at the rate of thirty-five to fifty times per hour. One bird was observed to feed her young seventy times in that period—an astonishing performance, the more so that it took place in an exposed locality during half a gale of wind. This increased activity is no doubt chiefly due to the greater abundance of food in late July, but the desire of the birds to set out on their southward journey is probably a contributory cause, making them restless and eager in their work.

The vocabulary of Willow-Wrens is an unusually limited one.

Apart from the song, the principal notes are: the "pooe" call and alarm-note (chiefly used as the latter); the buzzing-note of the male during pairing-time; the "cheep" note introduced on certain occasions between the songs. Other notes are uttered, but are less well-marked. Frequently a distinct difference between the call-notes of male and female in particular pairs can be detected, but I have been unable to satisfy myself whether this distinction is a sexual one, or merely individual. The note of the young on first leaving the nest is a very hoarse imitation of the "pooe" of their parents, and suffices to distinguish them for some time. The song usually wanes in July, and ceases between the middle of that month and early August. In some seasons, however, the break is hardly perceptible.* A few young males commence to sing in late July or early August, but the bulk of the autumn song, which extends into September, proceeds, I believe, from the old males, which after their moult are little less yellow than the young, and therefore not easily distinguished. I judge rather from the comparative excellence of the song. Once, and once only, I have heard a female try to sing. This was in May, during pairing-time, and appeared to be the outcome of sexual excitement; the song was very feeble, consisting merely of a few stammering notes, uttered very similarly to the very earliest efforts of the young males in autumn.

In August, among the roaming, playful, inquisitive bands of old and young, a recurrence of the buzzing-note of the courting season is repeatedly to be heard during early morning and forenoon. The birds uttering it appear to be mostly, if not entirely, old males. The accompanying song is low, but complete in utterance and prolonged; while the "cheep" note is also occasionally emitted. Indeed, except for the comparative absence of excitement, the bird's bearing is strongly reminiscent of that shown in May, about egg-laying time. This behaviour is interesting, showing apparent analogy to the autumn displays of such birds as Black Grouse.

* The break is longest in dry and warm seasons; shortest in wet and cool ones.

PHARYNGEAL TEETH OF FISHES.

BY COLONEL C. E. SHEPHERD (Indian Army).

(PLATE II.)

THE teeth of fishes, whether those visible on a cursory examination of the external characteristics of a fish, or those in the anterior part of the buccal cavity on the vomer, the palatine and pterygoid bones, and on the tongue, furnishing important data for the identification of a fish, have in all works on fishes received a good deal of notice, and are usually fully remarked on. But there is another set in the mouths of most Teleostean fishes that also deserves attention, but which, as a rule, has received very little notice. This is the set of the pharyngeal teeth, which, except in the case of the families comprising Wrasses and Carps, have received but scant and more often no attention. Anyone interested in this question can verify the importance of these teeth for himself by a short visit to the British Museum of Natural History at South Kensington. Here, by inspecting the show-case devoted to the anatomy of fishes in the small alcove off the Central Hall, the pharyngeal teeth of the Cod, Pike, *Amia calva*, Ballan Wrasse, and the formidable pharyngeal teeth of the Sunfish (*Orthogoriscus mola*) can be seen. In the large room set apart for fishes, by looking up into the mouths of the skeleton specimens of *Sciæna aquila*, *Bagarius yarrellii*, and *Lates niloticus* the pharyngeal teeth may be seen, and those of the Angler (*Lophius piscatorius*) can be studied. In a case, but separated from the skull, the very curious pharyngeal teeth of *Pseudoscarus muricatus* can be seen, and are well deserving of attention.

Pharyngeal teeth may be either villiform, which are very fine teeth, feeling almost like a smooth file to the finger; or cardiform, which are much stouter with a backward curve to them—this kind of tooth runs up to a comparatively large size,

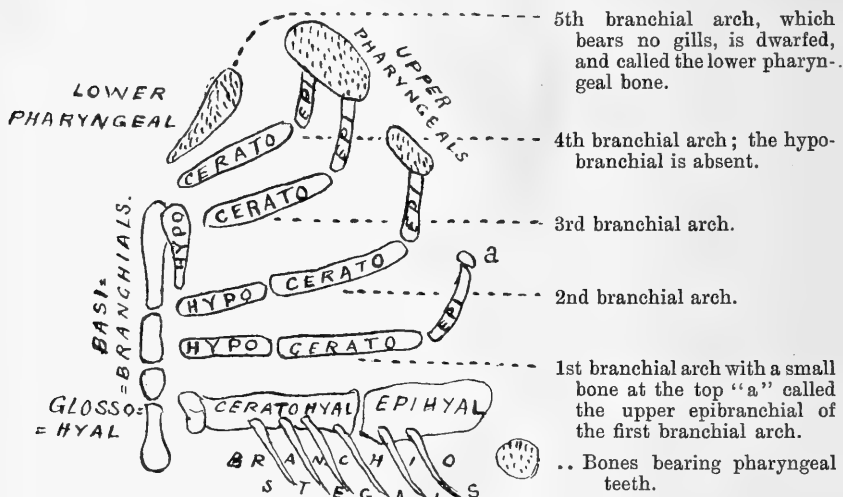
as in the Sunfish. Or the pharyngeal teeth may be crushing teeth of a granular form, as in the Wrasses (*Labridæ*); or molariform, set on stalks, and biting against a horny pad, as in the Carp family (*Cyprinidæ*); or of a pavement-like structure, as in the *Pseudoscarrus muricatus*; or setiform, like bristles, as in the Black Pomfret (*Stromateus niger*).

The external teeth and those in the anterior part of the mouth are adapted for seizing the fishes' prey. The pharyngeal teeth are, probably, the principal masticatory organs; in the Carp family (*Cyprinidæ*) they undoubtedly are. Some Teleostean fishes, *e.g.* the Twait Shad (*Clupea finta*), are devoid of any pharyngeal teeth. Fish that prey on other fishes and that swallow them whole would have the action of their gastric juices much facilitated for the process of digestion, if the scales of the swallowed fish were scarified and torn by the pharyngeal teeth, as they must be in the process of swallowing, rather than if the fish arrived in the stomach with its scaly covering intact; while fish that live wholly or partially on crustaceans, which may be called "the staff of life" for fishes, can give them a scrunch in passing through their pharynx that must loosen the shell of the crustacean and facilitate digestion. The Wrasses (*Labridæ*) that feed on shell-fish have their granular teeth in the upper and lower pharyngeals adapted to crush the shell, they not being provided with teeth in the front part of the mouth for this work, as is the case in the Sea Bream family (*Sparidæ*). The Carp (*Cyprinus carpio*), a vegetarian, finds its molariform teeth most useful for the masticating of its food, as do no doubt the rest of this family. The pharyngeal teeth also help largely in working the food down into the œsophagus, especially in those fish that have strongly cardiform teeth; and as the pharyngeal teeth are surrounded and embedded in mucous membrane, they probably, by their lacerating the skin of the prey, enable a fish to get a taste of what he is eating, a pleasure that fishes are not generally credited with enjoying.

To form a correct notion of the pharyngeal teeth and their place in the mouth, it would be well to get a general idea of the anatomy of this part. The accompanying diagram may help to impress on the mind the names and general situation of the bones. It is typical of the left half of a fish's gullet.

There are four gill or branchial arches that bear gills; the fifth branchial arch is stunted, bears no gills, but is furnished with teeth. The first three branchial arches, counting from the outside, are each composed of three bones—the hypo-, the cerato-, and the epibranchials. In the fourth arch the hypo-branchial is absent. The first branchial arch terminates in a

DIAGRAM SHOWING LEFT BRANCHIAL ARCHES AND BONES CONNECTED THEREWITH.



The 1st, 2nd, 3rd, and 4th branchial arches all bear gills.

small bone that helps in the attachment to the base of the skull, it is called the *upper epibranchial of the first branchial arch*. The second, third, and fourth arches terminate in the *epipharyngeal* bones, which carry teeth. The outermost arch is the longest, and they decrease in size inwardly; the *hypo-branchials* are connected with the *basibranchials*—they and the *ceratobranchials* form, as it were, the floor of the gullet; the *epibranchials* curve upwards and meet together at the base of the skull, forming, with the *epipharyngeal* bones, the upper part and back of the gullet, the *epipharyngeal* bones being one above the other, with that on the fourth branchial arch as the lowest. The fifth arch, the *lower pharyngeal bones*, with its teeth, is on the lower part of the floor of the gullet, and in advance of the oesophagus. The above is approximately a description of the

general scheme in the anatomy of a fish's gullet. It is subject to modifications in different cases, which will be noticed, if important, when treating of different fishes where such occur.

The branchial arches on their concave surface carry the *gill-rakers*, horny protuberances, often like the teeth of a rake, but in some forms they may be teeth-bearing tubercles more or less prominent, or the tubercles may simply be rough. These gill-rakers are provided to prevent solid particles that might injure the gills being carried into them; in some cases they form a perfect sieve, in others but a very inefficient one. The horny rake-like teeth, which are often denticulated, are generally on the outer side of the first branchial arch, and the tubercle forms on the inside of this and on the inside and outside of the second and third branchial arches, and the outside of the fourth. In some fishes the rake-like gill-rakers are on all the branchial arches. No account of the teeth in the pharynx of a fish would be complete without noting the teeth that in many cases bristle on the tubercles, or that line the inner side of the rake-like protuberances. In the following descriptions, therefore, the gill-rakers and the teeth on them will be noted, as well as those on the pharyngeal bones themselves, and also the teeth that are found along the surface of the epibranchials, yet distinct from those on the epipharyngeal bones.

SERRANUS GIGAS. Dusky Perch (Couch). Plate II., fig. 1.

This fish is occasionally caught in British waters. The detailed description of pharyngeal teeth may well begin with this fish, for it possesses a perfect armoury of sharp teeth in the posterior part of its mouth, as can be seen in the illustration. On the first branchial arch the gill-rakers are short and stout; there are sixteen of them from the angle of the cerato- and epibranchial towards the end of the hypobranchial, and nine along the epibranchial on the outer face of this arch. They all bear teeth on the inner side. The one at the angle is the longest, and has twenty sharp cardiform teeth on it; its length is contained about seven times in the length of the cerato- and hypo-branchial of this arch. There are teeth bearing tubercles on the inner face of this arch, which along the cerato- and hypo-branchial correspond with the position of the outer gill-rakers. There are

tubercles also along the epibranchial portion of this arch. The second and third arches have, on each side, tubercles bearing teeth; the fourth has them on the outer side. All these teeth are cardiform. The upper surface of the lower pharyngeal bones have a long, roughly diamond-shaped patch of villiform teeth, with a double row of strong conical-shaped, pointed teeth along the edge nearest the swallow. The lower pharyngeal teeth are seen near the centre of the illustration. The upper pharyngeal teeth consist of a long narrow patch at the top of the second epibranchial, two patches on the third epibranchial, and two patches on the fourth epibranchial. These latter four patches look like two on a cursory examination; it is only by working the bones that the division in them is realized. All are studded with strong cardiform teeth. By counting the teeth on some of the gill-rakers and on the tubercles, and taking an average of the teeth and the number of tubercles, and counting the upper and lower pharyngeal teeth as carefully as possible, a very moderate estimate would give the number of teeth in the inner mouth of this fish as three thousand two hundred. There are probably more.

SERRANUS SCRIBA. Plate II., fig. 2.

The gullet of this fish is a small-size replica of that of the preceding fish; the gill-rakers are modelled in the same way. On the outer side the first branchial arch has fourteen gill-rakers from the angle of the cerato- and epi-branchial to the end of its hypobranchial, and six along the epibranchial. The one at the angle is the longest, and about the same length as the gill just under it; the gill-rakers diminish in length in both directions as they get away from the longest one, till the further ones become flat tubercles. They all bear minute cardiform teeth on the inner face. There are tubercles on the inside of the first arch which bear teeth. The second and third arches inside and outside and the fourth arch on its outside aspect are studded with tubercles bearing small teeth. The upper pharyngeal bones bear villiform teeth, interspersed with some cardiform teeth. The lower pharyngeals carry villiform teeth, with a V-shaped row of conical upright teeth along the inside edge of the teeth-bearing plate, the apex of the V being towards the tongue. This illus-

tration shows the curious case of a fish, not one of the *Pleuronectidæ*, with a crooked mouth. It will be noticed that the left side of the fish is not symmetrical with the right, the branchial arches are stouter, and the teeth-bearing plate of the fourth arch, the lowest of the upper pharyngeal teeth showing on the left side, is malformed and out of shape. This is due to a natural deformity.

APOGON REX MULLORUM. Plate II., fig. 3.

A small-sized representative of the *Serraninæ*, has on the first branchial arch twelve gill-rakers from the angle towards the tongue, and four up the epibranchial. These bear minute teeth on their inner faces, and diminish in size as they get away from the angle of the branchial arch. There are tubercles on the inner side of this arch. The second and third arches have tubercles on each side, the fourth has them only on the outer side. These tubercles bear minute teeth. The upper pharyngeals have villiform teeth, with some cardiform ones along the upper part, the disc bearing them attached to the third branchial arch being larger than the other two. The lower pharyngeals bear villiform teeth in two patches of a triangular shape.

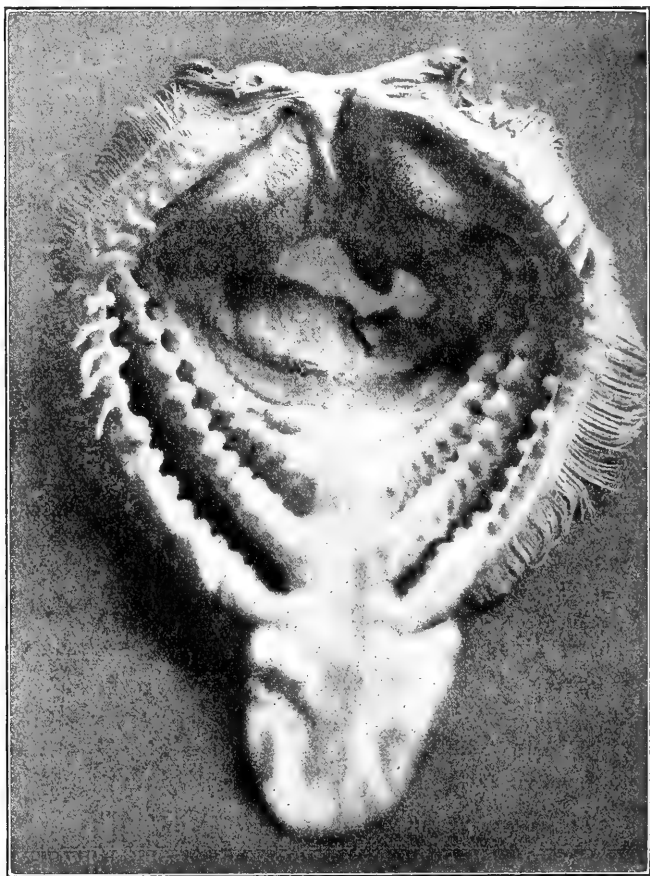
CENTROPRISTES HEPATUS. Plate II., fig. 4.

Another small representative of the *Serraninæ*. The first branchial arch has twelve gill-rakers from the angle forward, and five along the epibranchial along the outer side. These carry teeth. The inside of the first arch has tubercles. The second and third arches carry tubercles on the inner and outer sides, and the fourth on its outer side. The upper and lower pharyngeal bones carry villiform teeth. The teeth on the lower pharyngeals seem to join each side in the middle; there is not that distinct middle separation line that is noticeable in the *Apogon rex mullorum* at this part.

MORONE LABRAX.

This fish frequents the coast of England in the summer, and is known to fishermen as the "Bass." The first branchial arch of the specimen illustrated has thirteen gill-rakers on the left side, whilst the right side has fourteen, in the length from the angle to the end of the hypobranchial. There are ten on the

outside of the epibranchial. There are long horny gill-rakers in the middle portion of the branchial arch, the length of the longest being about one-fourth of the length of the cerato- and hypo-branchial combined. The gill-rakers dwindle in length from the angle each way, the last ones being short, but they do



MORONE LABRAX.

not become tubercles. All these gill-rakers carry fine villiform teeth on their inner side. On the inner side of the first arch there are distinct tubercles covered with fine villiform teeth. The second and third arches on each side of them, and the

fourth on its outer aspect, carry distinct tubercles with similar teeth. On the inner side of the fourth arch there are very small tubercles. The lower pharyngeals carry two leaf-shaped patches of villiform teeth, with a row of cardiform ones along the edge at the back and in the middle, and a few others close to the back edge. Where the second arch hypobranchials join the basibranchials there is a patch of villiform teeth on each side, showing very faintly in the illustration. Between the junction of the second and third hypobranchials with the basibranchials on each side, but in the centre of the mouth, there is a patch of villiform teeth, roughly circular in shape, but divided down the centre. The upper pharyngeal teeth are strong villiform teeth, arranged in five patches—two elongated ones along the epibranchials of the second arch, a roughly four-sided patch on the pharyngeal bone at the end of the third epibranchial, with a smaller patch on the outer side along the arch-bone, and a roughly circular patch on the pharyngeal bone at the end of the fourth epibranchial. The "Bass," according to Couch, feeds on smaller fish, crustaceans, and seaweeds.

THE VOCAL AND INSTRUMENTAL MUSIC OF INSECTS.

BY A. H. SWINTON.

(Continued from p. 306.)

I REMEMBER, when in the Island of Mauritius, being presented with a live stick-insect, which, much to my astonishment, suddenly expanded its fan-folded wings with a silken rustle and seemed to leap out of the window. Mr. Wood-Mason asserted that one—a *Pterinoxylus*—made a sound by rubbing a rasp on the costal vein of its wings across their diminutive covers, which was augmented by a talc spot. Entombed in the coal-fields, the stick-insects, grasshoppers, and cockroaches seem to blend with the dragon-flies and stone-flies. Nowadays *Corydalus cornutus* looks like the ghost of a bygone insect with jaws, and the ant-lions only retain them in their youth. A bit of wing belonging to the *Corydalus brogniarti* of Audouin, that dwelt among the gigantic horsetails of Colebrookdale, I once suggested to Dr. Henry Woodward had traces of a circular musical comb, but later on a scientist pronounced this to be the mark of the fracture in the claystone nodule that enclosed it; while, from the nature of their inhabitants, it remains more than probable that these early swamps resounded with the savage shrill of insect instrumentation.

The caddis-flies, again, blend with the scaly china-marks, bagworms, and clothes-moths, the *Acentropus niveus* found in some English ponds being a connecting-link. Among the moths that spin cocoons a few have bladders under their wings that resemble the drums of the Cicadas, and it is said they elicit sounds from these by rubbing them with their hind legs, but they have not any very conspicuous ear-cavities. They are possessed by the males of two rosy-flushed tiger-moths of the Mediterranean seaboard (*Cymbalophora pudica* and *C. certzeni*). De Villiers compared the sound made by the former, when flying

in the evening twilight, to the "tic-tac" of the needles of the housewife engaged in knitting stockings, and whenever I rub a hind leg of a desiccated specimen of the latter from a Jerusalem garden over the striations at the front edge of the bladder where the femur is wont to rest, I hear a noise like that made by the old black indiarubber when wetted; so, after being affrighted by the clatter of the Pheasant on the wing in a country lane, I can quite believe the assertion of De Villiers; both moth and bird seem sonorous. It is said the large "yellow tiger" (*Pericallia matronula*), rarely met with in the woods of Europe, possesses these balloons; they are just visible in the "Jersey tiger" and the "scarlet tiger" of our fenlands, but the common tiger moth that has caused an uproar which has been evident through a closed door is without them; it has good claws, and I have heard it scratch. They seem, indeed, to indicate a bygone relationship of the *Chelonidæ*, whose caterpillars feed on low plants, to the lichen-bred *Lithosidæ*, for the pretty flesh-coloured *Mitochrista miniata* that frequents the forest ferns has them faintly developed, and so has *Gnophria rubricollis* that flutters among the foliage. Those of the orange black-speckled *Setina*, met with in woods of Europe and Northern Asia, are far more conspicuous, and shine like spectacle-glasses; when Guenée held *Setina aurita* in his fingers, he declares that he heard it make a ticking like a watch, and a beating like a "death-watch" beetle. They may be found in the woods above Montreux, where they do not appear to be very common.

Mr. Henry Edwards, who passed his youth on the London stage, and later in life sat down to write a book on North American butterflies, has recorded his experience of the sounds made by Lepidoptera in the second volume of 'Insect Life.' Among other recollections, he tells us, when resting one day during the heat of the noonday sun under the shade of an acacia in the Plenty Ranges, some twenty miles remote from the bustle of the opulent town of Melbourne, how he was suddenly aroused from his reveries by the "whiz-whiz!" of two or three *Hecatesia fenestrata*, lovely orange-and-black moths, which were going in the fashion of the Swifts on the sidelong fling adown a woodland vista. On his return to America he heard the identical sound arise from a swarm of the *Alypia*

octomaculata, members of an allied tribe, whose caterpillars destroy the grape-vines, and he felt confident that on both occasions he detected the clubbed antennæ playing the tattoo on the wings like drum-sticks. An idea here arises whether the tale spots on the wings of certain large falcate winged moths are not adapted to produce a social buzz; a school-boy once told me he had made his kite buzz, but then he had cut a hole in it. Many stout-bodied moths whose caterpillars are cocoon-spinners, when they desire a partner, commence a vigorous wing-beating; the same rattle is heard when they are pumping in air to inflate their bodies for flight.

The "green silver lines" must be of lineage old, for their caterpillars construct the boat-shaped cocoons of the species of *Nola*, by some placed in the *Lithosiidæ*, as do those of some green moths which resemble the *Tortricina* in appearance. Forms that link the *Tortricina*, *Pyralidina*, and *Bombycina* are naturally ancestral; in one of the table-cases of the Marseilles Museum a tertiary moth with banded wings was to be seen. The fore wings of *Hylophila prasinana* have a sonorous pucker and a flap with a callosity that catches on the side-piece of the abdomen with a click, but as the moth executes its "scritch-scritch!" when flying, it would seem as if the callosity caught at the root of the veins of the hind wing. Mr. Kirby says this inhabitant of the oak-wood is common in Europe and Siberia. A specimen possessed by the British Museum used to be labelled "Australia." Some years the beating-stick brings it down plentifully in the New Forest, but as far as I know its twitter or squeak has only been heard in the north of our island. The Rev. Mr. Morris saw a large shoal of these moths flying and squeaking above the top of an old-fashioned hedge in a grassy lane at Stoke Court, and those seen by Mr. Headworth on June 4th in a wood at Gateshead, in Durham, were whirling frantically around one another in a waltz with a reiterated bird-like twitter, and a male that was captured squeaked on in delight until it was boxed. Dr. Buchanan White, on May 28th, heard a solitary male disconsolately squeaking as it gyrated around a small oak in Perthshire, and another later the same evening doing likewise, which looks as if there were a newly emerged female embowered in the silence. Those I saw come fluttering down in

the thicket of sapling oaks on the banks of Loch Fyne after dusk were toying in the fashion of the Swallows on the china plate, and one, or both, was clicking its make-believe kisses. We could imagine these moths are not deaf; they possess ventral cavities at the junction of the abdomen and thorax that may be adapted for audition. By nature indolent, somnolent, and apathetic, it is surprising they have so much life in them. If the birds learnt to sing beside the pebbly brook, they are surely trying to imitate the chirpings of the verdant, vernal groves, which poets assure us "are ever full of song and full of love."

Many of the males of the lichen-dappled, mouse-coloured *Noctuina*, branded with their family heraldry of lines, kidney, orb, and dart, are consummate dandies, with an extensible fan on a fleshy arm at the base of the hind body, which, when it expands, scatters on the dusky air a fragrance of turpentine or the vinaigrette. From the information afforded by Mr. F. N. Pierce, in his laborious work on the genitalia of the *Noctuidæ*, added to my own very partial investigations, I conclude these hair-pencils are possessed by the male of the quadrifid *Mania maura*, sometimes called the "old lady," that flies, dismal and black, into the apartment that overlooks the willows; by that of the "angle shades" (*Phlogophora meticulosa*), whose green caterpillar eats the garden fennel, and by those of the "sharks" (*Cucullia verbasci* and *umbratica*), that hide in the herbage. They are possessed by the males of the "wainscots," veiny, straw-coloured, or purplish, that, when the twilight darkens, are all on a flutter over the flowering grasses of the marshland; those of *Leucania conigera*, *lithargyria*, *littoralis*, *vitellina*, *pallens*, *albipuncta*, *l-album*, *straminea*, *extranea*, *obsoleta*, and *congrua* are all provided with them, as are those of their near of kin, *Nona-gria dissoluta*, *Caradrina brevilinea*, and others. One of this group, *Leucania loreyi*, is widely distributed; they rarely have the *Noctuina* pattern distinct. Scent-fans at the base of the abdomen are possessed by the males of certain moths, sometimes a canary-colour, that fly to lights in shady avenues; those of *Orthosia aurago* and *flavago*, *ypsilon*, *lota*, *macilenta*, and *pistacina*; and the males of *Caradriua subtusa* and *Conistra erythrocephala* thus secure a partner. So, too, do the males of a group coloured like the bark of the tree-trunks on which they slumber

in our parks during the day ; they are possessed by the males of the "grey daggers," *Acronycta tridens* and *psi*, and by those of the brown *Hadena rurea*, *basilinea*, *polyodon*, *satura*, *ophiogramma*, *hepatica*, *unanimis* and *scolopacina*, *Melanchra brassicæ* and *persicariæ*; by those of *Aporophyla nigra*, *Dipterygia pinastri*, and *Aplecta nebulosa*. Mr. Pierce finds that the male of the minute *Mianafuruncula*, whose caterpillar feeds in the stems of the *Festuca arundinacea*, has these scent-fans, which suggests their use, was discovered in the fens, where the *Nonagria*, ancestral forms of the straw-coloured group, as would appear, in like manner emerge from the stems of reeds and bulrushes. The plumes of *Lamphygma exigua*, as portrayed by Mr. Pierce, are found at the extremity of the hind body unusually developed ; they are inconspicuous or absent, according to the same authority, from the flat-bodied *Noctuidæ*, the "darts" and "yellow underwings" that fly out of hayricks ; and I have not noticed that the night moths with lichen-mottled wings possess them ; if the sweetly pretty "peach blossom" has also scented puffs, they may extend to the *Notodontidæ*. "Swifts" and a large number of the Geometers, the world over, carry their fans on their hind legs, and the "coloured underwings," placed among the night-fliers, have them on the second pair. I conclude it is from its habit of thrusting these forward when at rest on the elms and willows that *Catocala concumbens*, whose dainty pink renders it conspicuous among the North American "red underwings," has been said to have them on its front ones. Ought not its name to be pronounced "*concubens*"? I have recently found that *Melipolis sinualis*, a North American moth, has scent-fans continued in pockets on its second pair of legs. Other *Noctuina*, especially those of the genus *Plusia*, are adorned with a metallic glitter of spangles, but as all the moths have a more or less visible ear-cavity, with cells, drums, and attached ganglia on either side at the base of the abdomen, it would not be surprising to hear that they held sweet converse. An American entomologist says of *Catocala parta*, one of the "red underwings" frequenting the willows of Iowa at the close of the summer, "that it is the wariest of the genus, resting usually head up, hearing well, and taking flight at the snapping of leaves under foot." I quote from the 'Entomological News' of Philadelphia for January, 1909 ; and I might

mention that Mr. J. J. Fountain lately observed, in the 'Country-side,' that, when crossing at nightfall a meadow near Birmingham, he was surprised by a clicking sound, and suddenly found himself surrounded by the mustachioed males of *Heliophobus popularis*, that flew low over the grass where a newly emerged "feathered gothic" was holding its wings over its back and sounding the timbrel for a gathering. On examination I can only imagine the sound might have been made by the pucker at the base of the fore wing, but that *Orthosia flavago* makes a similar clicking, as stated, is astonishing. It was believed that Indian ants, provoked with a straw, began to hiss, until a question arose whether the sound was not made by their feet, as the boots of soldiers resound when a sudden halt is shouted.

The music of many insects is simply the din of a file with a chitinous resonance, recalling the rasping of a blacksmith's forge. I have never heard a spider emit any sound, but Mr. Wood-Mason has told the Entomological Society how *Mygale stridulans*, dislodged from a bamboo clump in Assam, on being attacked by his cat, elevated its head and threw its chelicerae into rapid motion, when certain chitinous, club-shaped rods, arranged comb-like on the inner surface of the basal joints of the palpi, grating on the outer surface of their penultimate joint, made an alarming whistle, recalling the muttering of an old man who has lost his teeth. Mr. Wood-Mason mentioned at the time that he had also a musical scorpion preserved in a bottle of spirit. The mouse-like squeak of the "death's-head moth" is somewhat similar in causation. Along the south-eastern coast of England, as on the lands of Brittany, *Acherontia atropos*, some seasons, is not uncommon, and its large green caterpillar is then commonly found when the potato plots are dug up. In 1865, 1868, 1878, and 1885, according to Mr. Richard South, it was unusually plentiful in the British Islands; 1867, 1878, and 1883 were corresponding years of most and fewest sun-spots, when the atmosphere was perturbed. According to my father's pocket-books, 1867 was fine, but the autumn was stormy in Hampshire; 1878 was a succession of thunderstorms—I do not remember such a summer except the one of 1883. The summer of 1865 was also sultry but changeable. During 1885, as the year previous, the cholera was prevalent in India and the South

of Europe. May was again cold, and the warm and humid summer in Surrey was productive of roses. Strange to say, this clumsy creature is sometimes seen flying out in the Channel. At the commencement of May, 1878 and 1882, individuals that had probably hybernated were taken on the coasts of Devon and Antrim. It is conjectured the "boanerge" squeaks in order to terrify the bees when it enters their hives to steal the honey, itself being deaf or dull of hearing, and inasmuch as the piping of the queen is understood to be a signal to swarm, and it is the custom to din on pots and pans when her colonists cluster around her on the horse-chestnut flowers, it is to be supposed that the bees who must hear, and who might perceive no evil omen in a skull and cross-bones, would quake with terror; invariably when it is disturbed it squeaks, but this would not hoax an Owl that feeds on mice. Still, this is not the only objection, for when the male moth squeaks it inflates its abdomen, and expands two yellow fans on either side into a star, which, like a composite flower, shed around their musky fragrance of jasmine or tuberose, comparable to that emitted by the feather tufts of the *Catopsilia* butterflies. At such times the "death's-head" has a remote resemblance to a large puff-ball. The alarming sound, according to Dr. Landois, is produced by the short tongue that it rubs along a striation in a groove that will be found at the base of the palpi, much as a scythe is whetted on the stone, for he discovered, when the palpi were removed, the moth could squeak no longer; and Mr. Joseph Anderson says, in the 'Entomologist,' that he is certain it is by the tongue that the squeaking is produced, for when he pressed it the noise ceased.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

A Sheep-killing Horse.—One of the cart-horses on a farm here has lately developed an intense dislike to sheep, and savagely attacks these animals when he can get at them. On two occasions he has succeeded in killing his victim, and would in all probability have destroyed a third, had he not been driven off by the shepherd. He goes at them with extreme fury, striking with his fore legs, biting, kicking, and kneeling upon them. Apart from his strange antipathy for sheep, this horse (a gelding of about seven or eight years old) is a quiet, good-tempered, tractable animal. As is well known, many mares running with their foals show great dislike to dogs, and the same may be said of cows, ewes, and sows when their respective offspring are young. The close affinity between wolf and dog, however, seems sufficient to account for this. But that the sight of an inoffensive herbivorous animal of comparatively small size should have the effect of exciting the rage of an otherwise amiable and well-conducted horse is hard to understand.—G. T. ROPE (Blaxhall, Suffolk).

Additional Notes on *Mus flavicollis*, Melch.—On Oct. 31st last I trapped a fine female of *Mus flavicollis* in a house cupboard set apart for household stores. The invading of man's habitation (*ante*, p. 243) by this mouse is not without significance, and tends to urge a still further claim for its establishment as a good species. True it is that there are many reports on record of *M. sylvaticus* being taken in houses. Many such reports have been conveyed to me, but on careful investigation all the captures reported were *flavicollis*, and not *sylvaticus*, though without doubt *sylvaticus* does occur at times in houses. Should anyone sufficiently interested in the matter of the house-loving proclivities of *flavicollis* wish to investigate the truth of this, let him lay down a few traps where potatoes or other "root" vegetables have been stored in a cellar, and should *flavicollis* occur in his neighbourhood he is almost certain to trap it there. It may be that in course of time our domiciles will

produce a fine and large species of house-mouse evolved from descendants of the Yellow-necked Field-Mouse. It is said, and probably with truth, that the House-mouse (*Mus musculus*) originally came from Asia, and in course of time spread its way throughout the world wherever man has gone. This mouse under various climatic influences has so diverged from the type that its many variations have received specific names, as *Mus gentilis*, Brantz., *M. muralis*, Bar.-Ham., *M. flavescens*, Fisher, &c. On the North Bull, Dublin Bay, there is to be found a house-mouse which, contrary to *M. flavicollis*, has forsaken man's habitation to lead a feral life (Journ. Linn. Soc., Zool., vol. xxvi. pp. 465, 473). In the directions given to numerous collectors of natural history specimens, all small mammals are wanted *except* those taken in houses. If, as we see to be the case in our British field-mice, other species take to a semi-domestic life, it will behove the collector of the future to give his attention as much to the house as to the field whilst engaged in trapping small mammals. I have in my possession a *M. musculus* mouse, which I took in a farm-building, so remarkable in colour—a bright yellowish fawn—that had it been taken abroad would certainly have led to a suspicion of its being a new species. The measurements of the house-trapped *flavicollis* mentioned above were: Head and body, 100 mm.; tail, 111 mm.; hind foot, 12 mm.; ear, 14 mm.—GORDON DALGLIESH (Midhurst, Sussex).

Intelligence of a Squirrel.—Referring to Mr. Dodsworth's article (*ante*, p. 361) on "Mental Powers of Animals," I may mention that in 1908, when passing a group of pine-trees in Bingley Wood, one of which contained a nest which could not have been long built, and thinking possibly it might be a Squirrel's drey, I gave the bole of the tree a vigorous kick, and afterwards I took hold of the tree with both hands and gave it a most violent shake, when in a few moments a Squirrel fell almost at my feet in a state of trepidation. Both of us for some moments were facing each other and motionless, after which I made a pretence of seizing it, but never for a moment thought of touching the animal, since I remember very well a person in North Yorkshire who once seized one under similar circumstances, and was bitten in a most vicious manner. The Squirrel no sooner saw me spring towards it than it made for a birch-tree forming part of a group which thinned out and ended in a solitary tree on a heath. I followed close after, shaking the trees in its rear, thus forcing it forward towards the solitary tree. This I did with success until the Squirrel was nearing the tree in question, when it at once appeared

to realize its position. It took but some moments to grasp the situation, when it determined to make back to the pine-trees; this, however, I prevented by severely shaking the birch-trees, but do as I would the Squirrel would not be forced to the solitary tree, and when I bent down to pick up a piece of peat to throw, the effect of which, I thought, would force it into the isolated position, it took advantage of this psychological moment to return to the clump of pine-trees from which it had been driven.—E. P. BUTTERFIELD (Wilsden).

P.S.—*Correction*.—On page 396 (*ante*), for *tywort* flowers read *figwort* flowers. This error occurs fourteen lines from bottom of page.—E. P. B.

Yawning of Rodents.—I have a White Rat (*Mus rattus*) which I have often observed yawning.—ELIZABETH RUSSELL (16, Beaufort Gardens, S.W.).

A V E S.

Kestrel and Starlings.—Although the following circumstance may have no real connection with Mr. Butterfield's experience (*ante*, p. 392), it has perhaps some interest of its own. On Oct. 19th of last year, near Havering, in Essex, I watched an adult male Kestrel harassing a flock of between two and three hundred Starlings. The latter birds were on the wing, and packed into an extraordinarily dense mass; they manœuvred in perfect silence, and appeared perfectly self-possessed and free from panic. The hawk was flying above and slightly behind the flock, and whenever a Starling became separated by a foot or so from its companions he made a vicious plunge at the isolated bird. This happened several times, and in each case the threatened Starling uttered a short note of alarm and turned into the ranks of the main body, while the hawk took up its former position. The flock drifted in an aimless course across the fields, accompanied by the vigilant and determined enemy, until each became invisible against the dark background of a distant wood. In less than a minute the Starlings returned, settled amongst a herd of cattle, and commenced to feed as though nothing out of the ordinary had occurred. I never saw the Kestrel again, and did not learn that any of its attempts had succeeded. In districts where the smaller Mammalia are scarce, and where the absence or scarcity of trees or bushes favours the operations of hawks, such birds as Redwings and Thrushes form the staple food of the Kestrel, and I am inclined to believe that such large birds as Mistle-Thrushes or Fieldfares are taken, for I have often found the feathers of the latter birds at times and in

places that suggested the work of the Kestrel and not the Sparrow-Hawk. I have seen the two smaller species pursued and killed by Kestrels on many occasions. At the end of July, on the moors near Selborne, in Hampshire, I found the remains of a full-grown young Cuckoo under circumstances that left little room for doubt that the slayer had been a bird of prey and not a mammal. Cuckoos, one would imagine, ought to be rather free from the attentions of hawks. —FREDK. J. STUBBS.

Rare American Teal in Co. Cork.—On Sept. 9th a fine specimen of a female American Blue-winged Teal was shot near Rostellan by Mr. B. Wise, of Maryland. It was exhibited at the meeting of the British Ornithologists' Club on October 17th, but, though agreeing as to the identity of the bird, a doubt was cast on its being a wild-reared bird, because Blue-winged Teal had been bred at Winslow, although no one had heard of any escapes from that collection. It might thus appear that the Club has come to the conclusion that no rare bird obtained in future will be looked on, without doubt, as a wild visitor while any of the same species are kept in captivity.—ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

AVICULTURE.

The Crossbill in Captivity.—‘The Zoologist’ for 1906 (p. 189) contains a few notes of mine on a tame Crossbill in our possession. We succeeded in keeping him till October 31st last, when he died. I noticed that for a week or two previously he seemed to lose strength, and to be unable to pull his fir-cones to pieces, but he fed well on seed to the last. He had certainly been caged for more than six years, and possibly longer, as when I first saw him in July, 1904, he was in mature yellow-green plumage. Two days after we lost him I saw another in a bird-shop in Ipswich, which was said to have come over from Belgium, and brought him home. The new-comer is at present in perfect health and plumage (yellow-green, like the other), and if he affords us half the pleasure and amusement we derived from our lost pet “Gyp,” I shall not regret the investment. During the great immigration of Crossbills last winter I had several opportunities of watching these birds feeding here on larches, and it is most interesting to see the same quaint attitudes in a tame bird, for no bird becomes more familiar in confinement than the Crossbill, or more ready to respond to kindness and attention.—JULIAN G. TUCK (Tosstock Rectory, Bury St. Edmunds, Suffolk).

NOTICES OF NEW BOOKS.

Reptiles of the World. By RAYMOND L. DITMARS. Sir Isaac Pitman & Sons, Ltd.

A DESCRIPTION of the reptiles at present found living on this planet is practically but a roll-call of survivors of the great reptilian era before the domination of *Homo*; to understand what that reptilian fauna was like when in its pride of place, the palæontologist must be consulted. We cannot ascribe the fall of this vast reptilian fauna to the sole action of man, though his hand falls heavy on the existing representatives of to-day. Thus we are again told of the Hawk's-Bill Turtle, continually hunted for the "tortoise"-shell obtained from its carapace. "The shields are removed from the shell by heating it, when they commence to peel, and are assisted in the process by the operator. As the operation often involves a living reptile, the martyred creature is turned loose afterwards, for the belief is that it grows a new coat of shields." The Diamond-Back Terrapin (*Malacoclemmys palustris*), "one of the requisites in making up a champagne dinner, and consequently a valuable and well-known market delicacy," has a market demand that we read "threatens early extinction." The Tuatera was in comparatively recent years abundant on the larger islands of New Zealand. Diminished by various causes, "they are diligently hunted for scientific institutions, and not many years will pass before the last Tuatera to remain in the flesh will repose within a museum jar." It should be here mentioned that Mr. Ditmars in this book, though following in the main Dr. Boulenger's system of classification, popularly divides the Chelonians into three groups:—

Tortoises.—The strictly terrestrial species.

Turtles.—The semi-aquatic and marine species.

Terrapins.—Those hard-shelled, fresh-water species that are edible and have a recognized market value.

A great deal of personal observation by the author himself is recorded in these pages, and this not only derived from captives

in the New York Zoological Park, but also from many of the creatures in their natural haunts. There is also very much valuable advice as to the treatment of reptiles in captivity, a subject of much difficulty, as most of us will bear witness who have travelled and endeavoured to keep these creatures. A coloured frontispiece and nearly two hundred illustrations from photographs taken by the author are not only a great assistance to the student, but give us the individuality of each species as only photography can disclose.

Mr. Ditmars has some pertinent remarks on the phenomenon of change of coloration in certain Lizards :—

“ It is a mistake to imagine the colour changes to be strictly in line of protection to the lizard in immediately conforming to the colours of surfaces on which the animal rests. A specimen capable of exhibiting all phases of coloration between a dull brown to an emerald-green may for some time rest upon a dead tree-trunk, and be clad in a suit of conspicuous steel-grey; from this hue it may transform into a livid green; a few minutes later it may jump among the leaves and shrubbery, where it takes on an almost blackish hue . . . Who can blame certain romantic authors for elaborating upon such an admirable point as the ‘power’ displayed by a dull brown lizard to jump upon a leaf and transform into a leafy green, thence upon a tree-trunk, where it immediately turns brown again, and from there, possibly, upon a gorgeous flower, where the reptile assumes a hue to match the richly-coloured petals?”

We notice that Mr. Ditmars, as regards the King Cobra, or Snake-eating Cobra (*Naja bungarus* = *Ophiophagus elaps*), states that it attains the great length, for a poisonous snake, of twelve feet. The writer of this notice, however, more than forty years ago, obtained and skinned a specimen in the Malay Peninsula which was afterwards identified and measured by Dr. Günther. Its length was 13 ft. 2 in. (*cf.* Zool. 1875, p. 4625).

A Monograph of the British Nudibranchiate Mollusca. Part VIII. (Supplementary). Figures by the late JOSHUA ALDER and ALBANY HANCOCK, and others. Text by Sir CHARLES ELIOT, M.A., D.C.L., &c. Ray Society.

THIS Supplement to the ‘Monograph on the British Nudibranchiata,’ by Alder and Hancock, will be welcomed by all naturalists, whilst the introductory sections give probably the

best general account of these creatures which has yet been written. We refer more particularly to this portion of the publication because it can be read with interest and profit by all zoologists, even if they possess no special knowledge themselves of the Nudibranchiate Mollusca. It embraces such subjects as Variation and Distribution, Bionomics, Embryology and Larval Stage, and Anatomy. In present speculative and theoretical suggestions—and they are valuable and stimulating—such records as these, referring to animal life not usually dealt with in evolutionary discussions, are of the very utmost importance, and will be found to be both qualitative and confirmatory on many disputed views.

Colour variation appears to be most striking in Nudibranchs. The range of colours comprises red, yellow, pink, brown, and grey of many shades, purple, slatey-blue, sage-green, and perhaps others. “In a series of specimens received from the Isle of Man slate-colour and greyish-blue predominate. At Plymouth red and yellow, though not universal, are very common. . . . At Plymouth many marine animals as well as seaweeds are reddish.” Both adult and young Nudibranchs appear and disappear suddenly in considerable quantities, especially before spawning and after hatching. Alder and Hancock were disposed to disbelieve in these migrations, but Sir Charles Eliot considers “there is a good deal of evidence for their occurrence. It is not known how they are performed, but as creeping is an extremely slow process, it is possible that the animals make use of currents in which to suspend themselves.” As regards protective resemblance, Nudibranchs frequently escape notice because their colour and to some extent their shape fit in with their surroundings, and, as Sir Charles Eliot remarks, “Of the reality of this phenomenon no one can doubt who has collected them in the tropics.” But he also qualifies some suggestions on this subject. He says:—

“These resemblances are striking, and clearly cannot be disadvantageous to the molluscs, but still I think that much of the language used about protective coloration, as if the animals were made to look like their surroundings by some special power either in themselves or external, is too anthropomorphic. It underestimates the importance of one commonplace factor in the situation, namely, that the two objects which resemble one another (such as the Nudi-

branch and the sponge or seaweed) have been associated and exposed to the same influences for unnumbered ages. Thus, whatever may be the causes which tend to give a sponge a certain appearance, they must also affect the Dorid which lives on the sponge, at least so far as they are external and concerned with water, temperature, and general surroundings."

In a footnote it also stated—

"that not only do Dorids resemble sponges (where the resemblance is advantageous to the Dorids), but also sponges resemble Dorids (where no such advantage to the sponge is clear)."

We are still in the wood of speculation!

There is as an appendix a useful bibliography of books and papers dealing with the Nudibranchiata of the Atlantic (including the Mediterranean and Caribbean Seas), which have been published since the completion of Alder and Hancock's Monograph in 1855, and there are eight beautifully coloured plates.

A History of British Mammals. By GERALD E. H. BARRETT-HAMILTON, B.A., F.Z.S., &c. Gurney & Jackson.

THE first part of Barrett-Hamilton's British Mammals has now appeared; it has been much anticipated, and, we are told, "its author has had its production before him for over twenty years." It is announced that the work will consist of three sections, dealing respectively with the Bats, the Land Mammals, and the Marine Mammals.

It is impossible to give from this part alone any adequate notice of the publication, as even the General Introduction to Bats is unfinished, and announced to be completed in parts ii. to vi. No one, however, can miss the recognition of its thoroughness in treatment and its wealth in reference. We must await the completion of a section before attempting to more fully review it.

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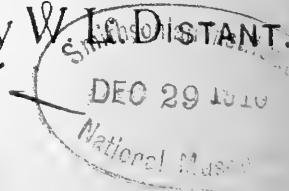
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THE ZOOLOGIST

No. 834.—December, 1910.

RECENT WORK ON THE INHERITANCE OF ACQUIRED CHARACTERS.

BY W. B. ALEXANDER, B.A., King's College, Cambridge.

It has long been known that a change in the environment may produce a definite effect on the structure of many animals, and until Weissman pointed out the theoretical objections to the possibility of such effects being inherited, it had been thought unnecessary to actually prove that this took place.

Since this difficulty has been generally admitted, the onus of proof rests with those who believe in the inheritance of acquired characters, and it must be admitted that nothing sufficiently satisfactory in the way of evidence has been adduced to shake the disbelief in such inheritance.

Certain recent work, nevertheless, suggests that, however great may be the theoretical improbability of the inheritance of acquired characters, the results of experiment cannot be interpreted on any other supposition.

The work of Tower on *Leptinotarsa*, the Colorado potato-beetle, has recently been brought prominently before the zoological world by Professor Bourne in his Presidential Address to Section D of the British Association at Sheffield. As this Address appeared in 'The Zoologist' (*ante*, p. 347), it will not be necessary to describe Tower's results in detail. He found that he could produce melanic varieties of the beetles by subjecting them to a slight increase or decrease of temperature during the

pupal stage. Albinic varieties were produced by subjecting the pupæ to a more considerable increase or decrease of temperature. Such changes were not inherited. But if the altered temperature was maintained during the adult stage some of the offspring were found to be similar to their parents. This effect was traced to the action of the environment on the germ-cells themselves during their maturation. For, if normal beetles were placed in changed conditions during the maturation of some of their eggs, and put back into normal conditions during the maturation of others, the adults arising from the first batch of eggs showed aberrations, whilst those from the second did not. The aberrations produced by the action of the changed environment on the maturing germ-cells were inherited completely—that is to say, individuals exhibiting such variations bred true in normal conditions, and when crossed with the parent form a typical Mendelian segregation occurred in the second generation, in each case the original form acting as a dominant to the variety. Now, if these beetles had been kept constantly in a changed environment, it would have appeared that the aberrations induced in the first generation by the environment had been inherited in the next generation; whereas, in reality, in the first generation the variation is merely a fluctuation, in the second it is of the nature of a mutation. When once the germ-plasm has been changed, it is natural that every individual resulting from that germ-plasm should show the same change, and this is exactly what Tower found.

We cannot, therefore, claim that these experiments support the inheritance of acquired characters, as at first sight they appear to do. On the contrary, acquired characters (*i.e.* characters produced in the somatic cells) are never inherited. For the changes to be inherited, it is necessary to directly influence the germ-cells.

The experiments of Standfuss on *Vanessa urticæ*, which were confirmed by Weissman, and those of Fischer on *Arctia caya*, yielded results which must be briefly considered. Fischer, for instance, found that by exposing the pupæ to a temperature of 8° C. a certain number of dark aberrant moths resulted. When a pair of these were mated and their eggs reared under normal conditions a certain number of the offspring were dark, but not

so dark as their parents. Standfuss and Weissman found that *Vanessa urticae* behaved in a similar way.

It is possible to bring these results into line with those of Tower, if we assume that in Lepidoptera the germ-plasm can be influenced even in the pupal stage, but the action on the germ-cell in this case does not influence the colour of the adult so much as the action on the pupa. We cannot, therefore, claim these investigations as a proof of the inheritance of acquired characters.

It is quite different, however, with the work of P. Kammerer on Salamanders and on Alytes, the results of which have been published in the 'Archiv. fur Entwicklungs-Mechanik,' Bd. xvii. (1904), Bd. xxv. (1907), and Bd. xxviii. (1909). I propose, therefore, to give a longer account of Kammerer's work, especially as, so far as I am aware, no such account has appeared in English up to the present time.

Two species of Salamander occur in Central Europe. The ordinary lowland Salamander is the Spotted Salamander (*S. maculosa*), whilst in mountainous regions it is replaced by the Black Salamander (*S. atra*).

The Spotted Salamander is black, with irregular large yellow markings on the back and limbs. This combination of yellow and black is a typical warning coloration, and indicates that the animal is poisonous. The female carries the eggs in her uterus for ten months, and in May enters the water, generally at night, and gives birth to from a few to fifty young, fifteen being about the average number. The young are surrounded by the egg-membrane, which either bursts before or shortly after expulsion. The new-born Salamanders have three pairs of long external gills, a long tail furnished with a broad dorsal and ventral fin, and four limbs, although these are small. The total length is about 25 mm. or 1 in. Their general colour is blackish, with a metallic golden and greenish lustre. They are very active, and at once eat dead or living animal matter. During the first six or eight weeks they assume a row of dark spots on the sides; these spots enlarge, and the whole skin becomes darker. Yellow spots appear next, first above the eyes and on the thighs, later upon the back; the ground colour at the same time becomes black. The metamorphosis is very gradual; the tail-fin

diminishes first, but the gills grow until shortly before the little creatures leave the water.

The Black Salamander differs from the Spotted Salamander in its uniform black colour and smaller size. It is restricted to the Alps at from 2000 ft. to as much as 9000 ft. elevation, living near waterfalls, or in other damp and cool situations. The most interesting feature of the species is that it produces only two young at a time. These are nourished at the expense of the partly developed eggs in the uterus, and they undergo their whole metamorphosis before they are born. Their development is divided by Schwalbe into three stages:—

(1) Still enclosed within its own follicle the embryo lives on its own yolk.

(2) Free within the vitelline mass, which is the product of the other eggs, the larva feeds by taking this in at the mouth.

(3) After the vitelline mass is absorbed, the embryo obtains its nutriment from the wall of the uterus by means of gills 10 to 12 mm. in length.

These two species of *Salamandra* are thus at once distinguished by their colour, habitat, and reproductive habits. Yet even in Nature they approach one another more than has been indicated so far. For the abortive eggs in the uterus increase in number in *S. maculosa* with increasing elevation of the habitat, the embryos decreasing in number and attaining a later stage of development before birth. The same process can take place in situations other than mountain districts if the conditions are unfavourable.

At the lower limit of *S. atra* an increase in the number of embryos may occur, three or four being produced at a birth, whilst the abortive embryos do not break up so early to form the vitelline mass. In the lower habitats of *S. atra* examples with small whitish spots are not infrequent. The yellow spots of *S. maculosa* are most complete in regard to number, size, and brightness of colouring in warm, moist localities on a clay soil, and diminish in size, number, and brilliance with increasing elevation of the habitat. These facts suggested to Kammerer the attempt to convert one species into the other, an attempt which has been to some extent successful.

If the embryos of *Salamandra atra* are liberated from the

uterus and placed in water, they cast off their richly vascular long red gills and regenerate in their place stouter branched gills like those of the larvæ of *S. maculosa*. Moreover, if females of *S. atra* are collected from the lower habitats and kept in warm conditions they often naturally deposit their young in the water in the larval stage, and these young are usually more than two in number. On the other hand, females of *S. maculosa*, which are deprived of the opportunity of depositing their young in the water, detain them to their final metamorphosis in the uterus. The nourishment in this case is exactly similar to that which normally takes place in *S. atra*, only a few embryos surviving, the rest breaking down to form a vitelline mass. These intra-uterine embryos differ from the normal free-swimming larvæ at the same age in their possession of long vascular gills. Their tail-fins are very small, and they retain their primary dark colour.

After metamorphosis these animals are still distinguished from normal *S. maculosa* of the same age by their smaller size and the lesser number of the yellow spots on the black background. Young *S. maculosa*, however reared, if kept on black earth at a low temperature and with little moisture, exhibit a preponderance of the black ground colour at the expense of the yellow spots. On the other hand, if young *S. atra* are kept on a clayey soil at a relatively high temperature and in a nearly saturated atmosphere, small whitish points appear on the skin, which sometimes expand into small yellow spots.

Salamandra maculosa can also be modified in the opposite direction, and become truly oviparous. This occurs if the female is stroked, or if she is kept in a completely saturated atmosphere, or if she is placed suddenly in ice-cold water. If the same individual is treated in this manner for several spawning periods, she eventually acquires the habit of laying her eggs early, even if the stimulus is not applied. From eggs obtained in this way the larvæ do not emerge for about a fortnight, and when hatched only possess the anterior pair of limbs, though the posterior appear the following day.

Under the same influences *Salamandra atra* can be got to produce her larvæ in the water in the larval stage, and then gives birth to from three to nine at a time instead of two. If

the stimuli are applied for several spawning periods in succession this method of reproduction becomes habitual in the individual, and occurs without further stimulation. The larvæ thus produced are coffee-brown or grey (instead of black), striped with darker bands. Their movements are much more intelligent than those of larvæ at the same stage which have been cut out of the uterus by an operation, and the gills become adapted for aquatic respiration much more rapidly. Moreover, they at once begin to feed on small aquatic animals. These larvæ, when they reach the sexually mature stage, in their turn produce aquatic larval forms even in the first spawning period, and it is found that the stimuli necessary to produce this result need not be so large in amount as was the case in their parents.

Exactly similar results are obtained with the young produced in the adult stage by *S. maculosa*. At the first spawning period they only produce one young Salamander in each uterus in the method normal for *S. atra*—that is, if the original experimental conditions are continued. Even if these conditions are not continued, they show the influence of their origin, though to a less extent. For they either produce relatively advanced larvæ in the water, which possess long uterine gills and metamorphose after a few days, or they produce larvæ on the land which have rudimentary gills, and are incapable of living in deep water. These land larvæ in a few days metamorphose to adult Salamanders, which from their small size and uniform black pigment might readily be taken for the young of *S. atra*. It thus appears that in every case an inheritance of the acquired developmental characters has taken place.

In a more recent paper Kammerer has published the results of a similar series of experiments on *Alytes obstetricans*, the Midwife Toad. The habits of this species in the wild state are quite unusual. It propagates itself on land, and lays from eighteen to eighty-six heavily-yolked eggs in a long chain; this chain is drawn out from the cloaca of the female by the male during the act of copulation, and at the same time he wraps them round his thighs. The gelatinous envelope of the eggs is very sticky, and attaches them to his legs, and by subsequent shrinking the band is drawn tight. While the male is in charge of the eggs he forsakes his usual habits, and diligently seeks for water in which

he can at intervals dip his legs, and if the eggs are kept wet enough the embryos eventually emerge into the water, biting their way out of the egg-shells by their horny beaks. Their post-embryonic development lasts more than a year.

Now, if *Alytes* is kept at a temperature of from 25° to 30° C., the male draws the eggs out of the cloaca of the female, but does not wind them round his legs. If this happens on land the adhesion is prevented by the rapid drying up of the jelly, but it more often happens in the water, since the heat causes the Toads to forsake their usual habits and cool themselves in the water, and here the adhesion is prevented by the rapid swelling of the jelly. The movements of the embryo inside the egg are sufficient to effect the disruption of the membrane, which is macerated by this swelling in the water, and the embryos escape after two weeks at a very early stage with a yolk-sac still attached to them, and long delicate, vascular embryonic gills. These gills are soon replaced by others adapted for respiration in the water. The post-embryonic development only lasts three to four months, and the resulting Toads are exceptionally large.

After a time the adults become accustomed to copulating in the water, and seek it for the purpose even when kept in normal conditions. They then produce from ninety to one hundred and fifteen small eggs with little yolk. This is soon absorbed, and the embryos, impelled by hunger, jerk violently about till they break out of the egg. Since they are not encumbered by a yolk-sac, as were those of earlier broods, they can swim freely at once, and to this end their tail-fins are distinctly broader than in the tadpoles derived from earlier broods. The gills also become more readily adapted to aquatic respiration. The Toads derived from the earlier broods reared in the water lay their eggs on land in the normal fashion if the experimental conditions are relaxed. Those derived from the later broods, however, after spawning in the water has become habitual, show that they inherit this tendency by always spawning there, even without continuance of the conditions.

If the high temperature is still maintained, the eggs produced by this second generation are still smaller and more numerous than in those of the first, and if the process is still continued the larvæ in the fourth generation are darkly pigmented instead of

colourless, have a broad tail-fin, and have three pairs of gills instead of one, these being already adapted for aquatic respiration when the larva hatches.

Sexually mature males in the third generation have rough callosities on the ball of the thumb, and in the fourth generation these are coloured black. In addition these males have hypertrophy of the muscles of the fore-arm. These two effects are evidently correlated with the extra difficulty experienced by the male in holding the female during the copulatory process, owing to her skin being wet and slippery in the water.

To return to the eggs laid on land and abandoned by the male. If they are kept on damp, cool soil they develop normally, but if the temperature is kept high they develop more rapidly, and if they are prevented from hatching at the proper time by only giving them the minimum amount of moisture very large eggs are obtained, in which the embryos remain for six or seven weeks, and when hatched are already 20 mm. long. If they are also kept in a feeble light giant eggs are formed in which the embryos remain for ten weeks, reaching a length of 31 mm., and possessing the hind pair of legs. The remaining process of development only takes about five months, and the adults produced are distinguished by their dwarf size. These dwarf Toads only produce sixteen to nineteen eggs, from which, if the experimental conditions are discontinued, larvæ emerge after about seven weeks. They are 21 mm. in length, and have undifferentiated stumps as rudiments of the hind limbs. If the experimental conditions are continued, the larvæ hatch out at an even more advanced stage than in the previous generation.

Larvæ from the original land-eggs, or from those in which the embryos have been retained for an extra long period, can live several weeks on damp earth instead of in the water. Their integument becomes thickened, and they develop epidermal glands and lungs; also the tail-fin diminishes, and the muscles of the limbs strengthened. They have to be placed in the water to undergo the metamorphosis, but this takes place in a very short time, the resulting adults being very much dwarfed. If the conditions are relaxed in the next generation, these induced modifications are almost lost, though the lungs are better developed than usual, and metamorphosis occurs earlier. If the

conditions are maintained, a further increase occurs in all the adaptive characters, and the larvæ can live even longer on land.

By prematurely opening the eggs laid in the water, and keeping the embryos in a poor light in a large quantity of cold water with a small food-supply, an *Alytes* larva was produced which remained for four years and eight months in the larval state, and produced eighteen eggs, which were artificially fertilized with the sperm of a normal male. The larvæ reared from these eggs under normal conditions were distinguished by the long persistence of the external gills, and after two and three-quarter years showed no signs of preparation for the metamorphosis.

Toads kept at a temperature below 17° C. take two years to become sexually mature. If kept above 25° C., this occurs in one year. Offspring of the latter in normal conditions became mature in a year and a half.

Now these results cannot be explained by a direct action of the environment on the germ-cells; for in most cases very little if any effect seems to be produced in the offspring so long as it is necessary to keep the parents in abnormal conditions to get them to change their spawning habits. As soon, however, as the changed habits have been acquired by the parents—that is to say, as soon as the parents can be replaced in normal conditions—then inheritance of these changed habits appears to occur.

We know that in such animals as change colour to adapt themselves to their environment the change is brought about, not directly by the action of the altered environment on the chromatophores of the skin, but indirectly by way of the nervous system. It is often supposed that the action may once have been a direct one, but that the perfection of the nervous system has led to its interposition in the process. Of course, the nervous system is not so directly connected with the germ-plasm as it is with the pigment-cells in the skin, but is it not possible that changes in the nervous system may affect the germ-cells? And there can be no doubt that a change in the characteristic habits of an animal is in some way correlated with a change in its nervous system.

In this connection it is interesting to notice that the chief

series of experiments on the inheritance of mutilations and diseases were those of Brown-Séguard on Guinea-pigs. His experiments consisted in performing various operations on the nervous systems of these animals, and noting the effects produced. He found that in a number of cases such effects were inherited by some of the descendants of the diseased animals.

Brown-Séguard's work is now discredited, since subsequent workers have failed to confirm his results, though it is probable that no one else has during thirty years reared so many thousand Guinea-pigs as he did.

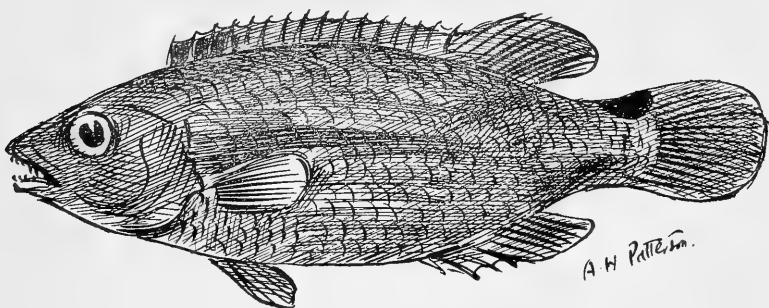
Until someone else has repeated Kammerer's work it is probable that such remarkable results will be regarded with some suspicion by orthodox zoologists, but the experiments are described so fully and accompanied by such clear figures that they ought surely to make us pause before absolutely denying the possibility of the inheritance of acquired characters.

SOME FISH-NOTES FROM GREAT YARMOUTH FOR 1910.

BY ARTHUR H. PATTERSON.

THE year 1910 provided me with no extraordinary ichthyological novelties, the only two items of more than ordinary interest being the discovery of a species of Bonito, which, so far as I can ascertain, has not before been recorded for the East Coast; certainly it is quite new to my own locality. The occurrence of the Velvet Crab is also worthy of note, as having made its appearance in local waters, and for the first time has found its name on the Norfolk list of species. These will be noted in chronological order.

On January 13th Mr. F. C. Cook, of Lowestoft, brought me two examples of Jago's Goldsinny (*Ctenolabrus rupestris*), which he had obtained on the previous day from one of the shrimp-



JAGO'S GOLDSINNY.

trawlers fishing just outside that port. This fish, since my discovery of it off Yarmouth in June, 1906, has not infrequently been taken in shrimp-nets. I am inclined to regard it, at present, as one of the most numerous of the *Labridæ* visiting Norfolk waters. A third specimen from a shrimp-net on August 9th.

A plentiful inshoring of Sand Dabs (*Pleuronectes limanda*)

occurred in March. On the 21st the shrimpers netted hundreds, one man on the 22nd having a "maund" (a fish-basket) full of them. They were in size little longer than a man's hand.

Ballan Wrasse (*Labrus maculatus*): A small example taken on April 11th.

On April 21st I saw a Smeared Dab (*P. microcephalus*), about $10\frac{1}{2}$ in. in length, with the fins surrounding it perfectly white, including the tail. The shopman obliged me by turning over some others on the slab, and we discovered two more almost identical in the peculiarities which characterised the first. I have no doubt they were varieties from the same brood, all being of exactly the same dimensions, and taken simultaneously. I have noticed this tendency to similarity in other instances, one curious "sport" having been accompanied by undoubted relatives.

A Ruffe (*Acerina vulgaris*), drawn down-river on an ebb-tide, was taken alive on Breydon on May 5th.

Obtained a double Flounder (coloured on both sides) on May 20th.

The Lamprey (*Petromyzon marinus*), I have no doubt, is an annual visitant to our Norfolk and Suffolk rivers, ascending for the purpose of spawning. It does not often come under notice, although on rare occasions some numbers have been recorded. On May 23rd a fine female was taken in a small trawl-net at the entrance of Breydon. I cooked this fish, but found the flesh dry and very beef-like in texture, and of a flavour that might have been a combination of Salmon and Skate. The eggs, which were imbedded in a blue-coloured tissue, were small and exceedingly numerous. Another was taken on the 24th, and two others subsequently. Great local prejudice exists with regard to the use of this fish as food.

Day ('British Fishes') speaks of two varieties of the Cod—the dark sort, taken off the Dogger, and the yellower kind, met with off the north of Scotland. I saw, in May, an almost black example with a light lateral line; the head and body seemed more slenderly built than in the typical Cod. I am much inclined to regard this fish as a hybrid between the Cod and Cole-fish, but it was too large an example to purchase for purposes of further investigation.

A fifteen-inch *Scomber concolor*—a whole blue-backed Mackerel without stripings—brought in on May 28th. Two or three Scribbled Mackerel (*S. scomber* var. *scriptus*) were met with during the progress of the fishing.

On June 8th a small schoolboy interested in Sticklebacks, as are most urchins, brought to me a large pickle-bottle in which were a number of very tiny Three-spined Sticklebacks. The boy had found the nest and carefully placed it in the bottle, judiciously adding some vegetable matter from the ditch, while the water was beautifully clean, although for some time unchanged. We could discern minute fish not more than a quarter of an inch in length happily swimming about in their small prison birthplace.

I had shown to me on June 9th a very fine example of *Sebastes norvegicus*. It weighed when full $17\frac{1}{2}$ lb., and when empty 14 lb. It was taken in the trawl, but no definite locality was obtainable.

An Eel was observed in trouble in a ditch at Belton, a few miles south of Yarmouth. A gardener, who saw it making queer antics in an evident endeavour to rid itself of something, shot it, when he discovered the body of a Water-Vole fast in the fish's gullet.

Breydon was alive with "whitebait" (Herring-fry) on the morning of July 30th. I was much interested for some time in watching a Heron standing beside a drain most industriously and adroitly snapping up these lively little fishes.

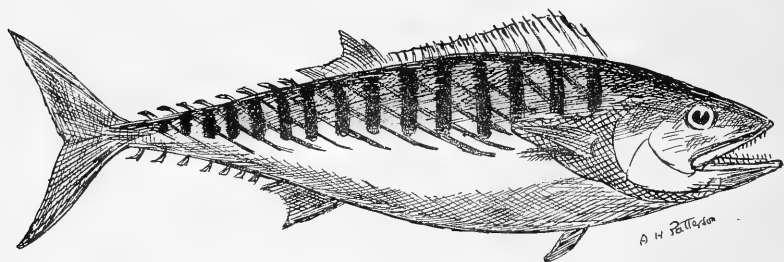
A very pretty example of a variegated Brill, 14 in. in length, came under my notice. The ground-work of the upper surface was white, but the tail and round the eyes exhibited the normal colouring, and nine spots were regularly dotted around the fish, four on each side, and one on the lateral line an inch or two off the tail. These spots were about the size of a florin.

An incursion of small Pollack (*Gadus pollachius*) noticeable during the third week in September; they were about the size of an average Mackerel.

September 24th: Saw a fine Porbeagle Shark (*Lamna cornubica*) on the fish-wharf, just landed from a fishing-boat. Length, nine feet.

Flounders coloured on both sides are by no means rare—all-white Flounders are rare. One was shown me on October 6th, seven inches in length; there was only a faint narrow brown ring around each eye. The upper surface was entirely devoid of spiny excrescences, and as smooth as porcelain.

My best find for the year was *Pelamys sarda*. When strolling to the harbour-mouth on the afternoon of October 30th—a wild dreary day, with a keen wind from the north-east, and with a great quantity of wreckage strewn along the shore—I noticed among other half-putrid fishes a Mackerel-like specimen from whose sides all the skin, save a little near the back, had been abraded by sea-water and the surf that had tumbled it to the tide-mark. I noticed at once its greater girth around the middle, and suspected it to be a Bonito of some sort, which



PELAMYS SARDA.

impression was strengthened by the rows of pronounced teeth, which were much larger and more conspicuous than in the Mackerel. I regretted having left my knife at home; and also the want of some newspaper to wrap it in. Roughly measuring it at seventeen inches, I left it. My rest at night was much disturbed by my disappointment at leaving it behind, and I was up before daylight on the following morning, when I hurriedly trudged to the harbour-mouth, where I was fortunate in re-discovering it just before the tide had reached it. The Hooded Crows had already been at it, apparently intending to finish the disembowelling they had begun on the previous day. I whipped out a table-knife with which I had armed myself, and was soon on my homeward journey with the head in my pocket. On reaching home I washed and put it into formalin, despatching it at night to Dr. Boulenger, who very kindly at once confirmed

my identification, assuring me it was the Pelamid, which is known also as the Belted Bonito, or the Short-finned Tunny. So far as I can trace, it is new to the East Anglian coast.

It is more than probable that Day's illustration ('British Fishes,' vol. i. pl. 38) is, so far as markings go, a correct representation of the species. It is, however, to my mind, a trifle too slender when compared with my example, as is Couch's figure, the markings of which do not correspond with Day's drawing. Yarrell's drawings of the Bonitos are to me confused and unsatisfactory. I regret the condition of my specimen, which, although so knocked about, could not have been dead more than three or four days. The Hooded Crows that had forestalled me in the discovery had already started disembowelling it, evidently deciding that it was not too far gone for their liking.

Elated by my "find" of October 30th, I was tempted to renew my visit to the harbour-mouth on November 12th, when, to my great surprise, lying among a few starfishes, weeds, and crabs drawn up at the tide-mark, I observed a large Mackerel-like head with pronounced teeth, and immediately recognized it as that of *Pelamys sarda*. In this case the body had been either cut or broken off, probably the latter, and it was in such a condition of decay as to warrant my belief that it had been netted a very short time after, or more likely contemporary with, my first example. The eye-sockets contained only the eye-casings, and the smell was rancid, my fingers retaining this pungent odour after a good washing. My opinion is that a small party of these Bonitos had attached themselves to the Mackerel shoals, and had come to grief in the meshes of the nets; their more acutely angled heads and stouter bodies, with their greater weight, had no doubt caused them to fall out and sink to the bottom. I do not think any fisherman, who could hardly help noticing some slight difference in them from their commoner brethren, would throw overboard such distinguished-looking fishes. In size and appearance, excepting advanced decay, both heads were exactly akin.

There have been considerable numbers of the Scad (*Trachurus trachurus*), or Horse-Mackerel, of a size not exceeding the Herrings themselves, taken in the herring-nets during the months of October and November. Their presence has been

much remarked on by fish-buyers at the wharf, as the fishermen, who now "cran" out their takes instead of counting them, throw them into the baskets promiscuously with Whitings, small Mackerel, and the like, on the principle of all going to make up bulk.

The first Sprats sent up from Suffolk appeared on the fish-mongers' slabs on November 4th.

When strolling by the beach to the harbour-mouth on November 6th, I observed many dead and decaying Mackerel and Herrings which had been thrown up by the tide. Several Picked Dogfishes, averaging two feet in length, were also stranded, with some one-pound Whitings. All of these were undoubtedly fish that had fallen from the nets. I also found two Guillemots, which in all probability had also met with their demise in the meshes of the herring-nets. It has been observed that many of the Mackerel have been bitten this year by Dogfish.

Garfish plentiful with the Mackerel in October and November.

The Herring fishery up to the time of writing has been a sadly disappointing one; a succession of boisterous storms, following quickly on one another, has marred the prospects of fisher-folk, and those who follow them. Only once or twice has there seemed anything like a full wharf. Gales have come on so suddenly and unexpectedly after the nets have been "shot" at sea that it has been impossible to haul them, and much damage through entanglement and breakage has resulted. To my mind the catching power is now vastly too great (thanks to company-mongering and greed for dividends) for the necessarily restricted area to which the spawning shoals resort. I hope I am in error, but in my opinion there is a danger of scaring and breaking up the "schools," and that some day—and maybe it is not far distant—the harvest of the Herrings will not be so remunerative as of late years. There is no close-season; the grounds are worked every day in the week (save in very bad weather), Sundays included, and in my estimation the restless turmoil of a throbbing steam fleet crowding there must have a detrimental effect. These opinions may be speculative, but those who prophesied a few years ago that reckless, unscientific trawling would destroy the feeding-grounds of the deep-sea fishes this side the Dogger, although then laughed at, lived

to see the decay of once prosperous deep-sea ventures. A fleet of handsome trawlers still sail out of Lowestoft, but the same adjective may not be truthfully used when their gains are mentioned.

Up to the middle of November the huge number of buyers and others who follow the Herring fishery had great cause for grumbling. Fish were scarce, and realized big prices. Boat-owners had reason to mourn great losses of nets and precious nights; and those who labour ashore—fish-house hands, Scotch girls who gut the Herrings, and many others—had far too much idle time on their hands.

The Herrings would seem to have been "spotty," *i. e.* unevenly distributed. One boat, fishing off Cromer, for a night's work secured but three crans; a boat not far off made a catch of 150 crans. Big prices have been made, fresh Herrings often making 38s., overdays 35s., salted 32s., per cran. One boat brought in, on November 14th, 220 crans for three nights' fishing, making £300 of her catch. Up to November 15th the season's total was 28,340 lasts, as against 37,732 lasts for a corresponding period last year. A last of Herrings is 13,200; there are ten crans in a last. That the local authorities do not share my pessimistic forebodings is very evident by the Port and Haven Commissioners setting about to obtain powers to add to the existing accommodation by making a dock of about sixteen acres in extent, capable of finding room for some three hundred or four hundred more fishing-boats. The congestion in the harbour has led to a great outcry among the fishing fraternity. The number of local fishing-boats numbers, roughly, three hundred; from Scotch and other ports, six hundred.

With regard to the summer Mackerel fishery, I have not many details. Mr. Jay, assistant wharf-master, gives me the figures for 1910 (the season lasting from April to August) as follow:—Forty-five vessels, lasts 278 = 1,780,000 fish. This compares favourably with that of 1909, when forty-seven boats accounted for 256 lasts = 1,560,000 Mackerel. A considerable number of Mackerel have been taken during the autumnal Herring fishing.

Off Yarmouth, during the autumn, some tolerable catches of Codlings of four pounds each and upwards have on three or four occasions been taken in five or six fathoms of water, just beyond

the breakers, after spells of unsettled weather, by sea-anglers more plucky than those who kept to the piers, and who had to be content with occasional takes of small Whitings in shallower waters.

From Mr. T. G. Robson, piermaster, Claremont Pier, Lowestoft, I have received the following information, which, now that sea-angling has become a national pastime, is of some little interest :—"Owing to the prevalence of easterly winds in October and the beginning of November, sport has not been so good as usual, our best week's total being only 8652 fish, as follows : Whitings, 8047 ; Codling, 562 ; Dabs, &c., 43—this was during the week ending October 30th. During the corresponding week of last year, by rod and line, the number of Whitings taken was 16,288 ; Codlings, 149 ; Dabs, &c., 95."

Mr. Robson states the largest Codfish taken so far this season was one weighing 29½ lb., caught from a boat; the largest taken from the pier weighing 16 lb. 2 oz. A Dab of 2 lb. 6 oz. was taken from a boat, and a Whiting from the pier 1 lb. 8 oz. One of the Lowestoft boatmen, fishing with a long line, secured in a single haul on November 4th twenty Cods, each over 20 lb., twenty over 15 lb., and twelve about 7 lb.

Mr. F. C. Cook, of Lowestoft, who is interested in the fishes of his neighbourhood, has provided me with the following items from notes made by him during the past year :—On February 22nd he observed the tail of a fish protruding from the mouth of a Thornback Ray, which, on pulling out, he discovered to be a Dab six inches in length. He noted that the Five-bearded Rockling was numerous taken in April by the shrimpers.

Heaps of Dogfishes (*Acanthias vulgaris*) were exposed for sale on the Lowestoft Wharf on May 27th, June 16th, and one or two other dates. Evidently there is a sale for them or the fishermen would not bring them in. Mackerel were observed to be much Dog-bitten in June. A Dogfish was noticed in the herring-dock eagerly pursuing "whitebait."

Flounders numerous in the basins in September ; among a large catch, to one rod, was a 2 lb. example. A 6 ft. Porbeagle Shark on September 20th. A Cod caught on a rod off Lowestoft late in October, weighing 29½ lb. Some good catches of Sprats netted off South Lowestoft, second week in November.

To Mr. Robert Beazor, senr., fish-merchant, who spends most of his time on the fish-wharf, I am again indebted for some interesting notes. He writes:—

“Crabs and Lobsters: These begin to make their appearance on the wharf immediately after Christmas, and in barrels, forwarded by rail from Scotland; these contain from six to eight score. The supply this year was scarcer, frequent and continuous winds not admitting of the catchers going after them. The same causes often prevented the Cromer, Runton, and Sheringham catchers from going to overhaul or work their ‘pots’; the take of Norfolk Lobsters was in consequence a short one. During July and beginning of August these ‘fish’ go into the sand to re-shell, the Crabs somewhat earlier, when supplies are very short. This year has been notable for the rather large numbers of fine Lobsters landed by the trawling smacks fishing in the neighbourhood of Cromer ‘wold,’ many running from 3 lb. to 7 lb.

“Smelts: Smelting commenced early in the year. The first taken was in the third week in March, and continued up to the end of September. It was a very poor season owing to the prevalence of easterly winds and turbulent weather. The greatest number I had in one day was between four and five thousand. Big catches were the exception. Very few Sea-Trout and Grey Mullet were captured in the smelt-nets, and hardly any along the coast, owing to the same conditions.

“Mackerel have been abundant on the coast all the year; our midsummer ‘voyage’ was a record one for the numbers of fish landed. Sea-Trout in some years have come into my hands from the mackerel-nets in scores, averaging from $\frac{3}{4}$ lb. to $1\frac{1}{2}$ lb. each, but this year they were conspicuously absent, as were Red Mullet [Surmullet], only three of the latter having been taken to my personal knowledge.

“The midsummer Herring fishery was a complete failure, and so I think it likely to be so long as the Fishery Board permit spring Herring fishing. I consider there ought to be a close-time on this coast from Christmas to June.

“Our autumn fishing up to the present has been backward owing to bad weather. Prices have been abnormally high. We have about one thousand vessels fishing from this port, over

six hundred of them Scotch and three hundred Yarmouth boats, now mostly steamers. The old sailing craft are becoming things of the past, owners having a great difficulty in securing crews to man them. Mackerel have been very freely taken with the Herrings, as have 'Horse-Mackerel,' which have been over-abundant.

"You ask me about Salmon caught at sea. I know of one of about 16 lb., being landed here in 1907 or 1908 by a steam trawler, that had been taken in the trawl-net, and another brought in by a steam drifter of $12\frac{1}{2}$ lb. weight, which had rolled itself up in the herring-nets."

Among the more interesting crustaceans that have come to hand may be mentioned a Sowerby's Hippolyte (*Hippolyte spinus*), a small, sturdy species with an extraordinary development of the rostrum, which reminds one of a cock's comb; so conspicuous is the little fellow, and so rarely found by our shrimpers, that its appearance is almost always noted by them when it occurs.

In May I secured a large pincer-claw of an Edible Crab with but one chela, and this the free-moving one, which, having no



MALFORMED PINCHER-CLAWS.

opposing point to close against, entirely precluded the possibility of this half nipper being of any use to its owner. On July 25th a large pincer-claw of the same species was handed to me

by a vendor of Crabs. It had an extra fixed chela protruding from the under side, at right angles to the under fixed chela (see fig.).

On August 14th I examined a Whelk with two opercula; the most extraordinary mollusc I ever saw, which, vulgarly speaking, was absolutely two-headed.

In August an undoubted occurrence of the Velvet Fiddler-Crab (*Portunus puber*) was noted by a shrimper, the specimen being saved for me by its captor until it became offensive. I was on my holidays at the time, hence it did not come into my hands. Fortunately another—a fine male example—was taken in a shrimp-net, and was brought home alive by the shrimper, from whom I received it next day. It had been placed in a bucket of water on a top shelf in his shop, but had died during the night, and its colours had much deteriorated. This is an interesting addition to the fauna of East Norfolk.

On December 3rd, owing to the unsettled state of the weather, almost all the Yarmouth boats were in port. Several crans of exceedingly fine Herrings which were landed from one of the boats realized the exceptional price of 49s. 6d. per cran, equivalent to 10s. per hundred! Most of the Scotch boats had gone home by this date.

THE COLOUR OF THE KINGFISHER.

BY FREDK. J. STUBBS.

JUDGING from the published remarks of British ornithologists, few people can be aware that the brilliant feathers on the back of the common Kingfisher vary from a deep ultramarine to pale straw colour, and that they alter strictly according to the conditions of light. Generally speaking, the bird is ultramarine when between the eye and the light; cobalt in the open air by almost every light, or in a room with good windows; green when the observer is between the bird and the source of light; and straw-yellow when the feathers are viewed at an extremely small angle, the observer being between the light and the bird.

There is considerable variation due to age and sex, and feathers from different parts of the body vary in intensity of colour, but they all behave exactly the same under similar conditions of light. The dorsal plumes nearest the tail are often the brightest and the bluest, but by arranging the bird in a suitable light they will be seen to change through green to a dull yellow—and, as I shall show presently, to a rich reddish brown.

Poets, presumably, draw their inspirations and ideas from birds seen in the field, and this explains why they are almost unanimous in speaking of the “sapphire blue” of the Halcyon. The artist in paint is not so lucky, for however well he may know the living Kingfisher, there is always a risk that he will fall into the error of making a careful study of a *green* Kingfisher in a dark case in some museum, and working this into the foreground of his picture. One frequently meets with instances of an indoor Kingfisher painted in an open-air picture; but, I remember, the bird appears in appropriate tints in a famous picture by Sir J. E. Millais. The descriptions published by ornithologists are one and all vague—at any rate, I have not read an exact description. Even Dr. R. B. Sharpe, who knew

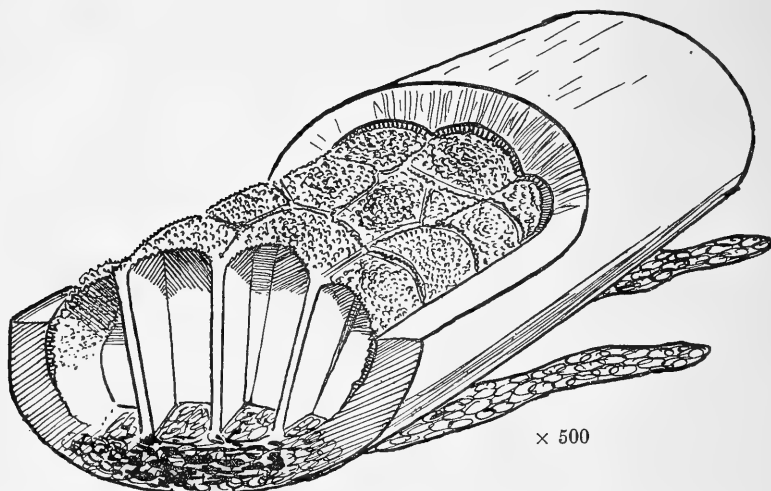
the Kingfishers very well, and William Macgillivray, who was the possessor of an extraordinarily sagacious eye, both describe the plumage of *Alcedo ispida* in a manner that is not precise.

What is the true colour of the Kingfisher? One is almost safe in saying it has none at all, for the blue parts of the feathers are colourless and transparent. Blue pigment has not been discovered in any bird, and green only in the small group of the *Musophagidæ*. Very few naturalists have investigated the nature of these unpigmented brilliant feathers. Professor Victor Fatio appears to have been the first, and his paper and plates (Mem. Soc. Phys. Hist. Nat., Genève, xviii. 1866) are very good. Yet he has one or two errors, and while describing the structure of the feathers (chiefly in the Indian Blue-bird, *Irena puella*), he offers no explanation of the cause of their blue colour. Some sixteen years later Dr. Hans Gadow examined the feathers of a number of birds, and described (P. Z. S. 1882) the blue ones of an Ant Thrush (*Pitta moluccensis* = *P. cyanoptera*). After noticing a series of ridges in the feathers of both *Pitta* and *Cæreba*, he suggested the theory of "Gitterfarben," or grating colours, to explain the blue of feathers. It may be stated at once that such ridges do not occur in the Kingfisher, although they are said to do so in other birds. Dr. Gadow was mistaken in saying that by transmitted light a blue feather is always the colour of its pigment; and there are one or two other points of error, such as stating that the colour is the combination of structure and pigment (which does not hold good for the Kingfisher), and in stating that the structural layer always overlies the pigment acting in combination with it (*cf.* also Newton's 'Dictionary of Birds,' p. 96).

Further consideration of the matter may therefore be advisable; but the difficulties attending the study of the minute structure of feathers are so many that I have had to confine my chief attention to the Kingfisher, and therefore I cannot speak definitely of many other birds. The following remarks apply, except where the contrary is expressly stated, to the blue feathers from the back of the common British Kingfisher.

I trust that the accompanying diagram will save me some verbal explanation. It figures, partly in section, a small portion of a single barb or ramus. The ventral or lower surface consists

of cellular *ceratin* or feather substance slightly pigmented with melanin. From this pigmented part arise the scanty barbules, which are also charged with melanin, although never appearing blue. Springing from the lower inner surface is a single stratum of polyhedral cells. Fatio, who was the first to describe this



important element of blue feathers, employed the word *émail*, and used the happy term *les plumes émaillées* for all blue or green feathers; all who have examined the feathers of the Kingfisher under the microscope must have remarked their resemblance to fine enamel. Around and above these polyhedral cells there is a strong tubular and transparent sheath, which is, as the diagram shows, simply a prolongation of the sides of the pigmented lower part of the barb.

These cells are alone the source of the blue of the Kingfisher. With care, the pigmented portion of the barb may be cut entirely away, without any appreciable difference to the brilliancy of the feather. This clearly proves that pigment is not always an essential item of blue feathers. In the Kingfisher, as in every other bird that I have examined, the transparent outer sheath may also be removed without affecting the blue colour beneath; in the above bird the sheath is colourless, but in the green feathers of some Parrots it is clear yellow. Here, again, my experience has never agreed with Dr. Gadow's statement

that the yellow pigment in green feathers always underlies the structural layer. The inner surface of the sheath is often (perhaps invariably) marked out in hollows corresponding exactly in shape with the caps of the cells below. There is a strong probability that these serve as tiny lenses, and increase the brilliancy of the parts below.

A single example of the polyhedral cells may now be examined in detail. It is about one-thousandth of an inch in breadth, and rather more in height. Its inferior wall or floor is formed by the upper part of the pigmented base of the barb, and the vertical walls are perfectly smooth, transparent, and colourless. The cell is empty, and the coloured nucleus figured by Fatio does not exist in fact.

None of the feather elements so far considered have any part in the production of the blue colour. The pigmented parts of the barb, the transparent sheath, and the vertical cell-walls may all be removed without destroying the blue. This is only produced by the tops or caps of the polyhedral cells. In spite of the fact that these objects rarely exceed $\cdot 025$ mm. in length, it is comparatively easy to separate one of the caps, and to arrange it for examination under the high powers of a microscope.

Even by means of a good hand-lens this tiny plate of ceratin is seen to be brilliantly blue. Under the compound microscope, using the highest power possible with incident light, the surface is seen to be finely granular, without the slightest trace of the ridges seen by Dr. Gadow in *Pitta*. I am unable to see the shape of these grains or wrinkles, but in the aggregate they look like the roe of a fish. The largest of them are plainly less than the one-fifty-thousandth of an inch apart, for I have counted forty separate cells in the length of a millimetre of barb, and estimated far more than this number of grains across a single cell top.

This plate of ceratin is not flat, but slightly conical (or *patelloid*), especially in the centre of the barb. In manipulation the apex may be pushed down into the middle of the cell, and so be rather misleading. Under a proper light it is all over brilliantly blue, *and the colour and structure are the same on both surfaces*. This highly important fact can be seen by mounting a single cap very firmly between two thin cover-glasses and

examining from both sides. The blue is only seen by reflected or incident light; by transmitted light the cap is a rich orange-brown, with no trace of blue. It is figured as the cell nucleus by Fatio, and described as the pigment by Gadow. Collectively, the cell-caps give the rich brown colour we see when we look through a Kingfisher's feather (especially slightly diagonally) at a strong light. The following striking experiment proves this orange—and sometimes blue—cap to be neither a coloured nucleus nor a pigmented cell-wall.

When a single cap (or, better still, a connected series) is mounted dry and examined by incident light, the blue colour can only be described as a glare. If we allow a drop of a mixture of xylol and Canada balsam to flow down the slide, the very instant it reaches the cell-cap the brilliant light is snapped off as suddenly and as completely as in the switching off of an electric lamp; and the most delicate adjustment of the microscope fails to reveal any further trace of the fragment of feather. By transmitted light, by which the cap resembles a flake of orange shellac, the xylol and balsam act in causing an obliteration almost as complete. When the fluid reaches it, the rich orange vanishes instantaneously, and all that remains is a thin and only just visible plate of perfectly transparent ceratin. Sometimes the disappearance is complete, and the cap is not seen again; but previous treatment with some such substance as fuchsin enables it to be kept always in view.

This experiment paves the way for a solution of the problem of the blue colour in the Kingfisher and many other birds. It is clear that the colour is not due to pigment, either directly (as yellow is produced in a Canary) or indirectly, as Dr. Gadow has said. The absence of striæ—and above all the behaviour of the colour under different arrangements of the light—enables us to dismiss the suggestion of "Gitterfarben." Leaving out of account polarization colours, which are impossible in feathers, we have but three remaining explanations to consider. The first is prismatic colour. If the grains on the surfaces of the cell-caps are prisms, we should certainly see under the microscope at least the sparks of some other colour besides blue—the tiny gleams of yellowish white are from a known source that it is not necessary to explain here. The case of the *Eclectus*, presently

to be described, hardly agrees with a prismatic solution. Many animal colours, especially in molluscs and insects, are due to thin plates; and probably many metallic bird colours are formed in the same manner.*

The microscopical appearance of the surfaces of the cell-caps, their behaviour in various media, and the fact that no other colour but blue is produced, leads us to dismiss the question of thin plate or interference colours in the feathers of the Kingfisher; but the greatest objection is to be mentioned later.

We have thus disposed of every explanation except one, and that is the theory of the production of blue by the reflection of light from small particles, and of orange or red by the transmission of light *through* small particles. I suppose everybody has noticed the bright blue colour of the smoke from a wood fire when seen against a dark background of woodland or mountain; seen against the bright sky, the smoke is no longer blue but orange. It is the same with a mixture of milk and water, where the minute globules of fat reflect a blue colour but transmit orange—for the fluid is decidedly yellow when held to the light. The blue of the human eye is said to be due to the effect of light on the particles in the substance of the iris; and it is well known to physicists that blue may be produced by condensing various gases, or more simply by dropping an alcoholic solution of mastic into a vessel of pure water. Yet we get the phenomenon on the grandest scale almost daily in the blue of the sky. By reflected light the colour is pure blue, but as the sun sinks to the horizon we see the atmosphere by transmitted light, and it is then orange. This is hardly the place to describe matters that are treated at length in every elementary book on light, but a couple of lines or so may be given. In white light the red waves are twice as big as the blue. When light impinges on a collection of tiny points a great deal is reflected intact as white light, but many of the red waves get broken up into

* I know this is not the usually accepted explanation of the metallic tints of feathers. If we take a blue feather from the neck of a Peacock, and cautiously wipe it with a solution of caustic potash, with the effect of thinning the outer layers of ceratin, the range of green and blue tints gives way to one of bronze-browns and reds. I cannot see how this fits in with the *prismatic* explanation; and there are other serious objections.

smaller waves, and thus we get a light that is lacking in long red waves, and overburdened with short blue waves. By transmitted light the opposite effect is produced, and an excess of red comes through to the eye.

Every observation made on blue feathers supports this theory of the "colour of small particles." The disappearance of the light and colour in xylol and balsam is due to the fact that the fluid sets up optical continuity; and the cap becomes, so far as its individual effect on light is concerned, a part of the balsam. We cannot easily order the experiment, but it sometimes happens when dealing with fragments of feathers that the balsam reaches only a single surface of the cap (as when the cell is still intact, but the outer sheath of the barb removed); and in this case there is only a marked diminution of the colour, and not complete disappearance.

I now come to some of the strongest points in support of the theory. *Eclectus polychlorus*,* a wonderful Parrot found only in the Papuan Islands, shows a strange dissimilarity in the colours of the sexes. The male is almost entirely a brilliant and nearly optically pure green, with small areas of blue and scarlet. The female is largely bright red, diversified with very slight washes of blue and yellow. Roughly speaking, the male is all green and the female all red. Krukenberg has studied the actual pigments of the feathers of *Eclectus*, and shows that these are the same in both sexes, although the general effect is so different. The pigments number only three, and are *melanin* (black), *araroth* (red), and *zoofulvin* (yellow).

A feather from the back of the male is green. The barb consists of a solid core pigmented with black, a single layer of cells with bright blue caps—exactly the same as those in the Kingfisher—and an outer transparent sheath tinted with the yellow zoofulvin. Here again the colour does not agree with Dr. Gadow's statements, for the underlying melanin has nothing to do with either the blue or the green (as may easily be tested by slicing the barb with a sharp knife), and the zoofulvin, which turns the blue colour of the cell-caps into green, is obviously

* Perhaps this may be particularized as *E. roratus* for the male and *E. cardinalis* for the female, but my remarks doubtless hold good for the other forms of this Parrot.

above and not below the structural layer. Viewed from the inside, the barb of the green *Eclectus* is exactly the colour of that of the Kingfisher, *i. e.* a fine azure blue. Nor is this all, for the blue of the female is produced in the same way, and the purple is due to the barbules and part of the barb being tinted with araroth; here the red does not overlie the cells, but shows on each side of the layer. The above facts simplify the question of the colouring of the sexes in this interesting Parrot, but cannot be further discussed here.

In several other green and blue birds these granulated cell-caps are present. The common Amazon Parrot (*Chrysotis*) is an accessible example. I have examined thoroughly the feathers of but a small number of birds; but I may as well say that I have never examined a blue, green, or purple feather (I do not now refer to "metallic" feathers) without finding the colour to be produced by the granular tops of the special cells I have described, but always as blue, modified by red pigment in the purple feathers, and by yellow in the green ones. It must not be forgotten that many apparently blue feathers are really grey. For instance, the blue feathers on the wing of the Shoveller are black, with a fine line of white along the centre of each barb. This is the method of blue production in many birds, but such feathers are never "enamelled." In a similar manner, green is formed by a combination of zoöfulvin and melanin, as in the Green Woodpecker.

What do these facts suggest? I read it that the bird can only produce blue or blue compounds in this single manner. If blue is required, the protecting outer sheath is colourless; if green, it is tinted with yellow; and if purple, a line of blue modifies the colour of a feather pigmented with red. Dark blue, as in the tail of the Kingfisher, or in the feathers of many other birds, is caused by narrow lines of blue-producing cells with wide and black interspaces. I need hardly say that were the colours due to prisms, or to thin plates, the overlying pigment would be unnecessary. Yet, as we see, the base of these colours is always the sky-blue reflected from the caps of elaborately fashioned cells.

Perhaps I may summarize, then, that the blue colour of the Kingfisher is not due to pigments; nor, as Dr. Gadow suggests,

to striæ acting as diffraction gratings—which would, of course, only display colour in fixed directions of light; nor is the colour due to tiny prisms, nor to thin plates. I trust that I have succeeded in showing that it is due entirely to the effect of light reflected from a vast number of tiny projections on the surface of the wall of a special cell, and is quite independent of any pigment.

All that remains now is to return to the first question of the varying colours of the plumage of the Kingfisher. When we see *only* reflected light, the feathers are pure blue; but when a large part of the light is reflected from the back of the barb, and of course transmitted through the cap of the cell as orange, this colour turns the blue into a dusky green, and in certain aspects it may even be the only light striking the eye, so that the feathers appear straw-coloured. It frequently happens that a Kingfisher is more brilliant by artificial light than it is by daylight—a curious state of affairs. The explanation is very simple. The light is so weak that only a small proportion is sent back through the cell-caps as orange light, and so we get the blue colour unmixed and brilliant. In brilliant old male birds very little transmitted light penetrates the caps, and so the blue is purer than it is in immature or female Kingfishers.

NOTES AND QUERIES.

MAMMALIA.

A Local Race of Light-coloured Mice.—Mr. Gordon Dalglish (*ante*, p. 434), in writing of *Mus flavicollis* and other mice, says:—"I have in my possession a *M. musculus* mouse, which I took in a farm-building, so remarkable in colour—a bright yellowish fawn—that had it been taken abroad would certainly have led to a suspicion of its being a new species." An almost similar experience befell me last year. I had heard of a peculiar light-coloured race of mice that inhabited a solitary farm at the head of an isolated valley (The Washburn) lying between vast expanses of high moors, and far away from contact with other human habitations. Through the medium of a friend I obtained a specimen in May, 1909, but far too "gamey" for any hope of preserving it. It was a female—adult, but slightly undersized—and of a fawn or sandy colour throughout. Coming from a virgin district, the specimen was interesting to me, and suggested possibilities; but I had my suspicions, and I instituted an inquiry through my friend to ascertain if any tame white or parti-coloured mice had ever been kept at this farm. Later my friend replied:—"You have, I think, diagnosed the case exactly. . . . I found that at one time one of the family used to keep 'white' mice." Whether these light-coloured mice are the direct descendants of the "tame" mice, or whether these latter have interbred with wild *Mus musculus*, it would be difficult to say now. But that they appear to have succeeded in producing a local race of fawn-coloured mice is, I think, worthy of record. An analogous case amongst rabbits is developing at present on some of the islands of the Farne group, *viz.* on "The Brownsman" and on "The Farne." The bird-watchers there have liberated some of the Belgian "hare" breed of rabbits, which are interbreeding with the ordinary British wild rabbit, itself formerly introduced into these islands, I am told. The result is that the greater proportion of the rabbits there to-day are of a distinct type—fawn-coloured, but of a lighter shade underneath.—H. B. BOOTH (Ben Rhydding, Yorks).

A V E S.

An Albino Bunting.—The word "Bunting" must be understood here in a generic sense, for the bird in question was so perfect an albino that I am unable to say whether it was, or rather is (for no one wishes to shoot it), a Yellowhammer or a Reed-Bunting. A Corn-Bunting it certainly is not. The movement of the tail proved it to be a Bunting, and a careful examination with a binocular when

it was busy with the seeds of the willow-herb suggested to me that it is probably a Yellowhammer. It has been haunting willows and sedges by the side of the railway like a Reed-Bunting, but there were Yellowhammers as well as Reed-Buntings about the same place. I could not catch any note that might have helped to decide the species. There is not a coloured feather in it, and it is, on a sunny morning, a most beautiful object. An albino Bunting of any species is, I imagine, a rarity.—W. WARDE FOWLER (Kingham, Chipping Norton).

Crossbill nesting in Bedfordshire.—On May 6th a friend and myself found in one of the pine woods at Sutton what was evidently the nest of the Crossbill; it had by some means become dislodged, and was lying upon the ground under the trees. Several Crossbills were seen at the time, and two males in full song were heard in this plantation previously. On May 8th, in a Scotch fir-plantation known as "Cæsar's Camp," at Sandy, we saw a pair with young; the latter had recently left the nest, and we watched the old birds return to feed them from time to time. My attention was first directed to this family party by the variation in the notes of the birds.—J. STEELE ELLIOTT (Dowles Manor, Salop).

A Variety of the Gannet (*Sula bassana*).—The variety of the Gannet described by Mr. R. Fortune (*ante*, p. 340) is, I imagine, the first variety of this species ever recorded; moreover, it is doubly interesting, because it belongs to a very different class from the albinisms and melanisms which are from time to time reported among all birds. There is also an account of it in 'British Birds' (iv. p. 153), with a very good photograph by Mr. Jasper Atkinson, done from the bird as it sits on a rock beside two of the normal colour, with one of which it was believed to have paired. This is a *lusus naturæ* which is hardly explicable by the ordinary laws of variation in plumage; to account for it we may perhaps suppose an abnormal intensifying of the buff head and occiput, which is worn by the Gannet in its adult livery. If that be the solution, the buff pigment has not only spread over the entire head and neck and part of the wings, but has turned to a darker colour. There is another and, I think, more probable explanation of this strange freak. It may be a last year's bird still retaining some of its immature plumage, though now faded and altered so much as to be unrecognisable. But against this theory it is to be remembered that a young Gannet's plumage is black, not brown, and another point is that the dark plumage is always lost on the head and neck first, the lower back and tail being the last part to change.—J. H. GURNEY (Keswick Hall, Norwich).

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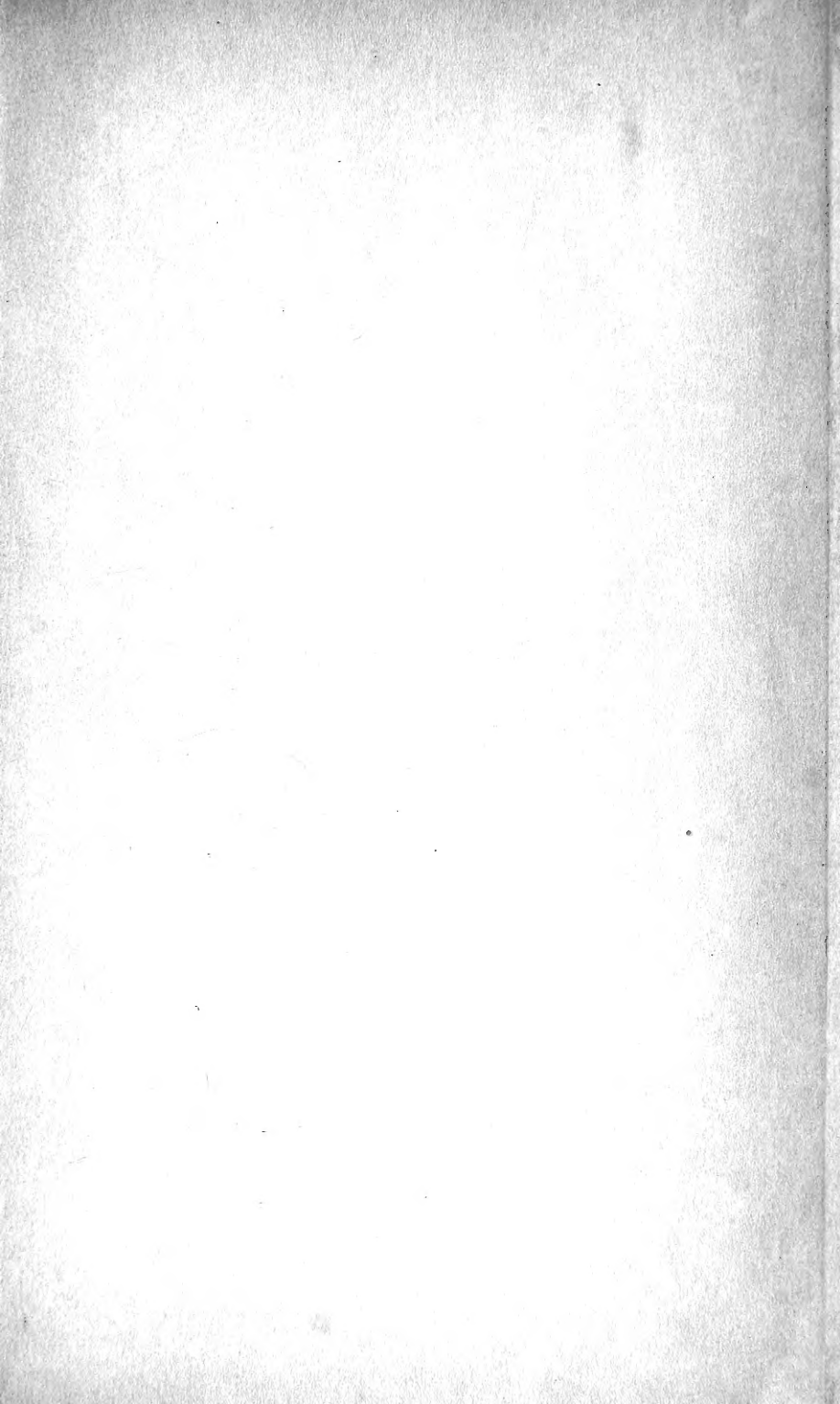
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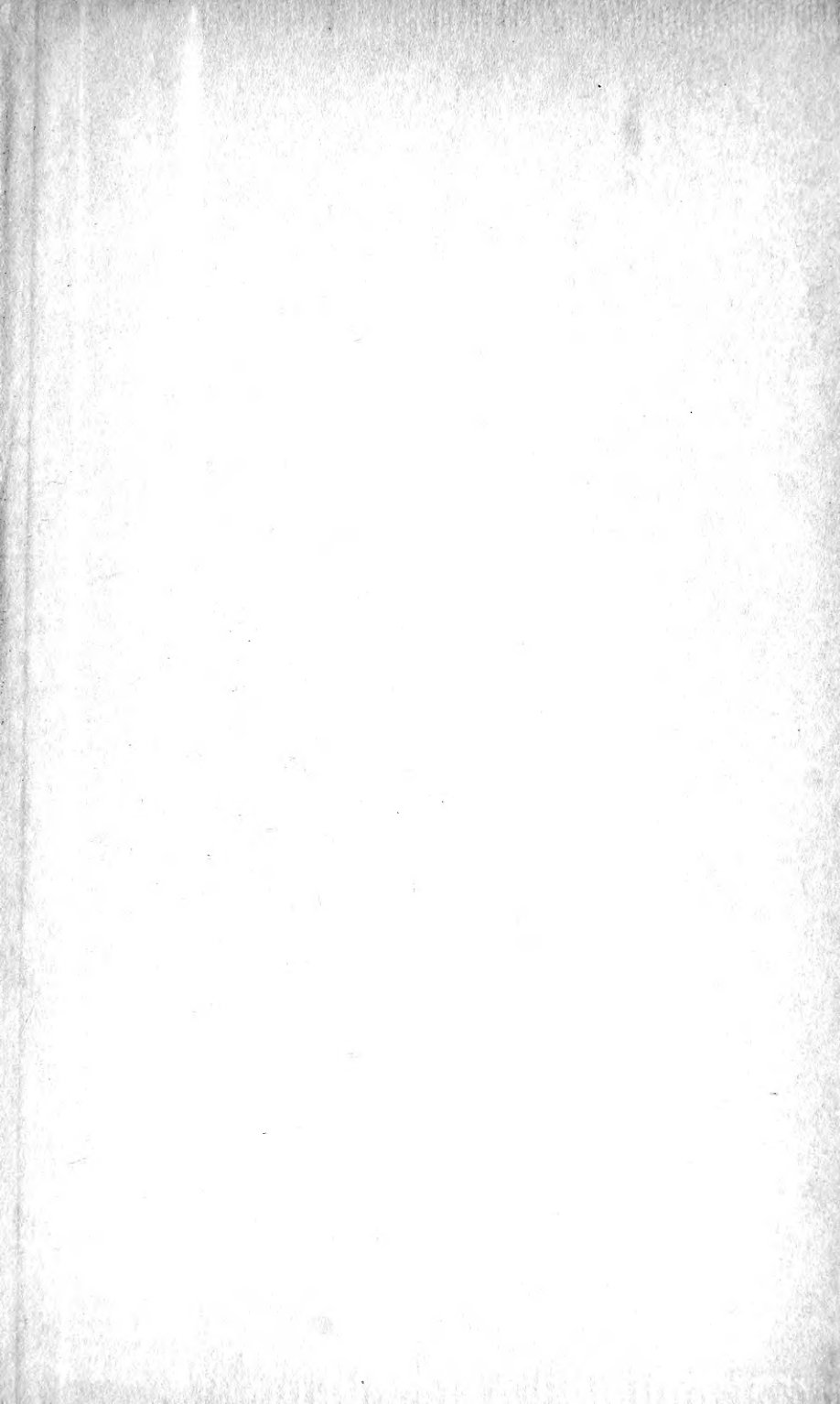
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